Society for British Entomology

Journal

V. 6 (1958-59)

Vol. 6 Parts 1 & 2

Journal

of the

Society for British Entomology

World List abbreviation: *J. Soc. Brit. Ent.*

Date of Publication: 1958–1959

Copies may be purchased from the Publications Secretary, Department of Entomology, The Museum, Manchester, 13

DATES OF PUBLICATION

		Pages
Part 1	22nd August, 1958	1–36
Part 2	27th May, 1959	37–59

On 1st January, 1960

"*The Journal of the Society for British Entomology*"

was amalgamated with

"*The Entomologist*"

The two periodicals were published in January, 1960

as

"The Entomologist

Incorporating the Journal of the Society for British Entomology"

Volume 93, No. 1160

CONTENTS

SYDENHAMS, PRINTERS, BOURNEMOUTH

VOL. 6 PART 1

JOURNAL OF THE SOCIETY FOR BRITISH ENTOMOLOGY

World List abbreviation: *J. Soc. Brit. Ent.*

EDITED BY
E. J. POPHAM, D.Sc., Ph.D., A.R.C.S., F.R.E.S.

WITH THE ASSISTANCE OF

W. A. F. BALFOUR-BROWNE, M.A., F.R.S.E., F.L.S., F.Z.S., F.R.E.S., F.S.B.E.
W. D. HINCKS, D.Sc., F.R.E.S.
B. M. HOBBY, M.A., D.PHIL., F.R.E.S.
G. J. KERRICH, M.A., F.L.S., F.R.E.S.
O. W. RICHARDS, M.A., D.Sc., F.R.E.S., F.S.B.E.
W. H. T. TAMS

DATE OF PUBLICATION: 22ND AUGUST, 1958

Copies may be purchased from the Publications Secretary,
Department of Entomology, The Museum, Manchester, 13

Price 20s. 0d. post free

Published for the Society
by the British Trust for Entomology Ltd.

BRITISH TRUST FOR ENTOMOLOGY LTD.

41 QUEEN'S GATE, LONDON, S.W.7

All official correspondence should be sent to the Secretary of the Trust

JOURNAL OF THE SOCIETY FOR BRITISH ENTOMOLOGY

VOL. 6 22ND AUGUST, 1958 PART 1

EDITORIAL

On 1st January of this year the Society for British Entomology became amalgamated with the British Trust for Entomology Ltd., in accordance with the conditions outlined in a previous editorial. Although the Society will continue to retain its identity, publish its *Transactions* and *Journal* and hold its biennial congresses, its activities will also be integrated with those of the Trust. On 1st January all ordinary members of the Society became members of the Trust and vice versa. In future issues of the *Journal* news of the Trust's activities will become a regular feature. It will be observed that Mr. N. D. Riley and Professor Varley represent the Trust on the Council of the Society for British Entomology and four of the Society's officers are also members of the Trust's Council of Management.

The amalgamation of the two bodies has largely been accomplished as a result of the initiative and foresight of Mr. N. D. Riley on behalf of the Trust and Mr. G. S. Kloet as President of the Society. Much detailed discussion has taken place between these two gentlemen to ensure that the amalgamation of the two bodies should take place upon a sound and lasting basis. It is now up to those of us who are now members of the Society and the Trust to do all we can to make the amalgamation an outstanding success and to exploit to the full the increased opportunities of service which the amalgamation offers.

At the end of last year the office of Secretary became vacant owing to the resignation of Mr. J. G. Blower. When the Society moved to Manchester two years ago Mr. Blower was elected to the office of secretary. It is largely due to his drive, initiative and prudence that the Society's sales of publications has rapidly increased during his period of office. It is a tribute to Mr. Blower that his resignation from the office of secretary has left not one but two vacancies. In thanking Mr. Blower for his services we wish him every success in the future.

Firstly we are glad to welcome Dr. H. Henson, of Leeds, as General Secretary of the Society, and secondly Dr. Hincks, of the Manchester Museum, has been elected to the newly created office of Publications Secretary. Mr. H. N. Michaelis will in future deal with all correspondence concerned with membership of the Society.

The Society passed through a most difficult period during World War II and the years that followed it. The gradual decline in the value of money and the rise of costs added to our difficulties. Yet today the Society is as active as it has ever been and its prospects for the future most encouraging. It is upon this note of thankfulness and hope that we start new volumes of the *Journal* and *Transactions*.

Protective Devices of Enodpterygote Pupae

By D. G. Sevastopulo

Some thirty years' experience of tropical insects in India and East Africa enables me to add some first-hand examples to those mentioned by Dr. H. E. Hinton in his paper of the same title (1955, *Trans. Soc. Brit. Ent.*, **12**: 49-92). For the sake of brevity, I shall enumerate them under the headings listed in Dr. Hinton's paper.

(IV) Passive Protective Devices

A. General protective devices of cocoons

The common Indian Lasiocampid, *Trabala vishnu* Lef., is a good example of a cocoon on a twig protected by a barricade of silk and setae spun above and below the cocoon itself. When the cocoon is spun on a leaf, the whole of the leaf stalk and the leaf surrounding the cocoon is similarly covered. An interesting point is how those Lasiocampid species with transverse dorsal folds on the fore part of the body of the larva containing spiny setae contrive to push these setae point outwards through the fabric of the cocoon. I believe that the larva pushes the fore part of its body hard against the newly spun cocoon, thus causing the spines to penetrate the silk and become detached. The Indian *Lebeda nobilis* Walk. and the African *Pachypasa* spp. and *Nadiasa* spp. all have cocoons that are almost impossible to handle without being pricked by these spines.

Most Limacodids seem to spin cocoons with the larval urticating spines placed in patches at either end, but the African *Latoia albipuncta* Holl., which spins its cocoons close together, covers them completely with short, erect, golden-brown setae. This is the only *Latoia* species that I have bred, so that I am unable to say whether the habit is a general one in the genus.

As regards the Lymantriidae, in my experience it is not the visibly hairy cocoons of *Dasychira* and *Hemerophanes* whose handling gives rise to skin irritation, but the completely hairless cocoons of *Euproctis*. The long hairs, common to most Lymantriid larvae, are not the real irritants. The irritants are the almost microscopic setae of the round subdorsal patches of adult *Euproctis* larvae.

B. Retention of larval cuticle by pupa

1. *Protection by warning colour of larval cuticle*

In *Chrysopsyche mirifica* Butler, as well as in various species of *Lechriolepis* and both *Trabala vishnu* Lef. and *T. lambourni* Baker, the larval cuticle is a shrivelled shred and the larval colours hardly show. This is curious in view of the fact that Poulton (cited in Hinton) claims that the warning colours of the larval cuticle of *Chrysopsyche varia* Walk. afford the pupa protection. The Lymantriid *Cropera testacea* Walk. also ejects its larval cuticle from its thin web-cocoon, but this has no warning colours nor is it very hairy.

C. Protective colours of pupae

1. *Concealing colours and shapes*

Here I would mention the very stick-like pupae of the *Chilasa* group of the Papilionidae and also the dead-leaf-like pupae of many *Polydorus* species. These are very different from the normal *Papilio* pupae, the *Chilasa* group being almost cylindrical without the usual thoracic keel, whereas the *Polydorus* species have a series of small, rounded, upright lobes along the edge of the abdomen. Neither of these groups has the usual Papilionid power of colour adjustment. *Papilio dardanus* Brown has a peculiar flattened leaf-like pupa, quite unlike any other *Papilio* pupa known to me, and, as might be expected, this pupa is always green.

A number of Lymantriid species that pupate under thin transparent webs spun across the trough of a leaf have green pupae.

The Sphingid *Atemnora westermanni* Boisd. belongs to this class. The pupa which is olive-brown and resembles a dead leaf is placed in a few netted threads amongst litter on the ground.

2. *Warning colours*

The Lymantriid *Naroma signifera* Walk., pupates under a thin web on a trunk of a tree. It has a noticeably aposematic pupa: white with orange-centered black markings. The pupae of many species of *Acraea* are similarly coloured.

The Indian Lymantriids *Leucoma ochripes* Moore and *L. sericea* both have whitish pupae marked with chestnut and black. *Perina nuda* F. is greenish below but has chestnut dorsal markings that are bordered with black, thus the ventral side is protectively coloured and the dorsal is aposematically coloured.

The Arctiids *Amphicallia pactolicus* Butler, *A. tigris* Butler, *Argina amanda* Boisd., and the Phalaenid *Egybolis vaillantina* Stoll., all have orange-brown pupae of varying shades marked with black and enclosed in a thin web. These pupae can certainly be classed as aposematic.

D. Special protective resemblances

1. *Special protective resemblances of cocoons*

(b) *Resemblance to cocoon from which parasitic wasps have emerged*

I have bred *Deilemera apicalis* Walk. (Seitz has *D. antinorii* Oberth. as a synonym of it). The frothy bubbles are produced *per anum*, the spinning larva pushing them through the silk, to which they adhere. These pellets are double, as the pellets of frass are often double, and they contain an oily fluid with the same smell as the yellow liquid exuded by both Coccinellidae and Zygaenidae. *Deilemera restricta* Butler and *D. itokina* Auriv. do not adorn their cocoons with such bubbles.

2. *Special protective resemblances of pupae*

(b) *Resemblance to monkeys*

Holland's figure (reproduced in Hinton's paper) of the pupa of *Spalgis lemolea* Druce is not a good likeness, and I consider the idea that these pupae resemble monkeys far-fetched. The pupa, of which I have seen a good number, is far more like a blobby bird dropping, an olive-brown central part surrounded by chalky white.

(c) *Resemblance to a pupa from which parasites have emerged*

The gilded spots of many Danaid and Nymphalid pupae from certain angles look like small holes from which parasites have emerged.

(d) *Resemblance to a pupa attacked by moulds*

A number of other Lycaenid pupae, especially of the genus *Anthene*, have a dense coating of erect, white setae, but these are not usually dense enough or long enough to be taken for mildew.

(f) *Resemblance to bird excrement*

In addition to *S. lemolea*, the pupae of the Indian *Pratapa deva* Moore and the African *Mylothris chloris* F. strongly resemble bird droppings. The pupa of the African *Euchrysops barkeri* Trim. bears a strong resemblance to the dropping of a mouse or bat.

The following two pupae do not appear to fit into any of Hinton's categories. The Indian Geometriid *Terpna ornataria* Moore pupates in a folded leaf. The pupa is yellowish green with a large pale spot ringed with chestnut enclosing the spiracle of the 6th abdominal segment. Before pupation the larva bites holes through the leaf and through these holes the pale spot of the pupa is clearly visible. The habit of biting holes through the leaf containing the pupa is quite a common one amongst the *Hemitheinae*.

The second species is the African Hesperiid, *Eretes lugens* Rog. The pupa is yellowish green with a dark brown star-shaped mark on the head. The larva pupates in a leaf cell, and the dark brown mark presumably looks like a creature of some kind, perhaps a spider, to anything entering the cell from the front.

Corxids of Berkshire

By P. W. Hanney

West Berkshire is poor in aquatic habits because piped supplies have led to the neglect and eventual disappearance of dew ponds in this predominantly chalk down region. A few gravel pits occur in the Thames and Kennet valleys. The substrate of central Berkshire is predominantly clay with alluvial gravel in the Kennet valley. Plateau gravel occurs in isolated areas, particularly in the south. East Berkshire is similar, but has more plateau gravel and sand with its associated heathland type of vegetation.

The major aquatic habitat types in Berkshire, apart from rivers and streams, are gravel pits, small artificial lakes and ponds, some formed by damming of valleys, meadow ponds and small dew ponds excavated for watering livestock. There are also a number of small stagnant ponds formed by excavation of gravel.

Table 1

Relative Numerical Status of different species of Corixidae as indicated by representative collections from Berkshire

Species	Total sp. taken	% Total No. of Corixidae	No. of habitats in which taken	% No. of habitats
Cymatia bonsdorffi (Sahl.) ..	26	0.5	5	5.6
C. coleoptrata (Fabr.) ..	150	2.8	11	12.4
Glaenocorisa cavifrons Thom.	2	0.02	1	1.1
Corixa lateralis Leach ..	315	6.0	26	30
C. nigrolineata Fieb... ..	514	10.1	26	30
C. concinna (Fieb.)	20	0.4	3	3.5
C. praeusta (Fieb.)	255	5.0	37	40.6
C. semistriata (Fieb.) ..	40	0.8	3	3.4
C. limitata (Fieb.)	44	0.8	6	6.8
C. scotti (Fieb.)	405	7.9	14	16
C. fossarum Leach	205	4.0	14	16
C. falleni (Fieb.)	469	9.2	35	40
C. distincta (Fieb.)	158	3.1	32	36.3
C. germari (Fieb.)	5	0.09	4	4.6
C. castanea (Thom.) ..	251	5.0	12	13.6
C. moesta (Fieb.)	110	2.1	14	16
C. linnei (Fieb.)	105	2.0	16	18.2
C. sahlbergi (Fieb.)	494	9.7	44	50
C. punctata (Illig.)	767	15.1	56	63.6
C. dentipes (Thom.)	2	0.04	2	2.2
C. panzeri (Fieb.)	17	0.3	6	6.8
C. dorsalis Leach	723	14.2	53	60.2
Total No. of Corixidae	5,077	Total No. of Corixid habitats	88	

Eighty-eight habitats for Berkshire were examined and the aquatic Hemiptera collected recorded. A summary of the species obtained is given in Table 1.

Corixa falleni and *C. dorsalis* are the dominant corixids of gravel pits and lakes generally, but *C. dorsalis* is more widespread and occurs in lesser numbers than *C. falleni*. *Corixa dorsalis* is associated with running water and is frequently the only corixid in fish ponds and gravel pits stocked with coarse fish. *C. falleni* is usually regarded as a caliphile and the Berkshire records support this view, though as few specimens were found in acid water. *C. fossarum* was also common in rivers and streams. *C. praeusta* has a preference for still water and introduced organic matter. *C. scotti*, *C. castanea* and *C. sahlbergi* were the commonest species of acid lakes and ponds, but in other habitat-types *C. dorsalis*, *C. falleni*, *C. distincta* and *C. punctata* were the most abundant.

Glaenocorisa cavifrons was recorded from a deep acid lake sheltered by pine and oak woods with a substrate of clay and gravel. *C. concinna* was only found in gravel pits and is associated with deep open waters. *C. semistriata* was only recorded from heathland ponds lined with peaty mud and sphagnum pools. *C. dentipes* was found in a small acid lake, while *C. panzeri* was abundant in a shallow gravel pit.

Details of the collections are deposited with the Editor for future reference.

OBITUARY

Philip Harwood

Philip Harwood died on 17th August, 1957, at his home in Wimborne, Dorset, aged seventy-five. He was the younger son of W. H. Harwood, of Colchester. He entered the Westminster Bank in 1900, retiring in 1942. His last post was in Bournemouth, where he was the manager of a branch. For some years after his retirement he lived near Aviemore in Invernessshire. Harwood was one of our most distinguished Coleopterists, being especially outstanding in his field work. From his father he inherited a fine collection of Aculeate Hymenoptera, to which he added considerably during his life. He was also very interested in the Hemiptera, Symphyta and the Diptera. His collections have been divided between the British Museum (Nat. Hist.) and the Hope Department, University Museum, Oxford. Harwood joined the Royal Entomological Society in 1910, and was a founder-member of the Society for British Entomology. His wife died shortly after his decease, and there are no children of the marriage. S.C.S.B.

Yorkshire Agromyzidae (Diptera)—Part I

By H. M. Russell, F.R.E.S.

Since the publication of Kloet and Hincks' "A check list of British Insects." 1945, the list of British Agromyzidae has grown from 90 species to 246 species (Spencer, 1956), and when one compares the latter figure with that for Sweden—302 (Ryden, 1954)—it immediately draws attention to the fact that many more species must remain to be discovered in this country.

With Volumns I and III of Prof. E. M. Hering's "Bestimmungstabellen der Blattminen von Europa" now readily available in this country (and Volume II promised for the near future) it is to be expected that interest in the Agromyzidae will be stimulated and that distribution data covering either mines or adults will, in due course, appear in the various journals covering entomology.

The major part of the published records of British Agromyzidae refer to captures by Messrs. Spencer, Parmenter and Griffiths in the southern half of the country and in order to provide a link with the Scottish records published by Spencer (1956) I am setting out hereunder a preliminary list of 50 species which I have taken in a few Yorkshire localities either as leaf mines or as adults. The limestone uplands of this county contain a large and varied flora which should yield many more interesting species.

Examination of the Yorkshire Naturalists' Union Diptera records yields information on several species taken as adults by the late C. A. Cheetham and W. J. Fordham, but it is unwise to bring these forward until such time as the specimens have been checked.

I should like to express my very best thanks to Prof. E. M. Hering and Mr. K. A. Spencer for assistance with determinations and to Mr. L. Parmenter for assistance in obtaining part of the literature.

The botanical nomenclature follows that of Clapham, Tutin and Warburgh's "Flora of the British Isles," 1952.

Agromyza albipennis Mg.—Food-plant: *Phragmites communis* Trin. Puparia were found in mines at Scarcroft, near Leeds, in November 1955, from which flies emerged in April and May 1956. A broad linear mine is formed down the leaf and the puparia are very conspicuous in the pale, dead leaves in late autumn.

A. alnibetulae Hd.—Larvae active in mines in *Betula pubescens* Ehrhart. at Tarn Fen, Malham, during July 1956.

A. anthracina Mg.—Mines in *Urtica dioica* L. at Scarcroft, near Leeds, during July 1955.

A. demeijeri Hd.—Adults reared from mines in *Laburnum*, Whitkirk, Leeds, July 1957. The mine passes from one edge of the leaflet round the tip and along the other edge, commencing as a thin line and broadening considerably before the larva emerges to pupate in the earth.

A. nana Mg.—Larvae active in mines in *Trifolium*, fields near Newthorpe Quarries, Micklefield, August 1956.

A. spiraeae Kalt.—Mines very common in *Potentilla erecta* (L.) Rauschel, Tarn House Plantation, Malham, August 1955, and in *Filipendula ulmaria* (L.) Maximowicz, Tarn Fen, Malham, 24th July 1956. Adults taken at Grasswoods, Grassington, during June 1956.

Phytobia (*Poemyza Hendel*) *lateralis* Macq.—A single specimen by sweeping over grass, Scarcroft, near Leeds, July 1955. A grass-miner widespread throughout Europe.

P. (*Poemyza Hendel*) *pygmaea* Mg.—Mines in *Phalaris arundinacea* L., Bardsey, near Leeds, 20th June 1955.

Phytobia (*Trilobomyza Hendel*) *verbasci* Bche.—Mines in *Verbascum thapsus* L. at Aberford, near Leeds, August 1955.

P. (*Dizygomyza Hendel*) *iraeos* R-D.—Larvae active in mines in *Iris pseudacorus* L. at Scarcroft, near Leeds, August 1956, and Tarn Fen, Malham, September 1957.

Cerodonta denticornis Pz.—Adults taken in small numbers at Temple-newsam Woods, near Leeds, by lightly sweeping over grass, a large proportion of which was Yorkshire Fog (*Holcus lanatus* L.), a known food-plant of this species, June 1957.

C. fulvipes Mg. (*spinicornis* Macq.).—A single specimen from Rawdon, near Leeds, August 1956. Mines recorded from *Poa*.

Liriomyza amoena Mg.—The spot mines of this species are to be found on Elder (*Sambucus nigra* L.) in and around the Leeds area during June, July and August.

L. artemisicola de Meij.—Mines in *Artemisia vulgaris* L., Thorner, near Leeds, August 1955.

L. eupatorii Kalt.—I swept a single specimen of this species from the Tarn Fen area of Malham Tarn on the 26th July 1956. The food-plants are recorded as being *Eupatorium cannabinum* L. and *Galeopsis* spp.

L. fasciola Mg.—Mines in *Bellis perennis* L., August and September 1955, Scarcroft, near Leeds. Larvae active in mines in same food-plant, Barnbow, near Leeds, August 1956.

L. flaveola Fall.—Adults reared from mines in the grass *Holcus lanatus* L. taken from Tarn Fen and Tarn Close, Malham, on the 24th June 1956. Adults emerged on the 22nd and 24th July 1956.

L. strigata Mg.—Adults reared from mines in *Taraxacum officinale* Weber taken in Tarn Close, Malham, July 1956. Mines of this species in *Senecio fluviatilis* Wallroth. (Saracen's Woundwort), Tarn Close, Malham, September 1957.

L. valerianae Hd.—Mines in *Valeriana officinalis* L., Tarn Fen, Malham, 24th July 1956.

Phytagromyza hendeliana Hg.—Mines in *Lonicera periclymenum* L. are quite common in the Scarcroft, Bardsey, area during June, July and August.

P. populi Kalt.—Active larvae in mines in *Populus x canadensis* Moench., Leeds, 31st July 1956.

Napomyza elegans Fall.—Three specimens taken by light sweeping over grass, Adel, near Leeds, 29th June 1956.

N. glechomae Kalt.—Mines in *Glechoma hederacea* L. at Thorner, near Leeds, 12th June 1957.

Phytomyza affinis Fall.—Mines common in *Cirsium* spp. at Scarcroft, near Leeds, during August 1956. Adults emerged on the 2nd, 4th and 5th September 1956.

P. angelicae Kalt.—Mines in *Angelica sylvestris* L. at Scarcroft, near Leeds, 23rd June 1956.

P. angelicastri Hg.—Mines common in *Angelica sylvestris* L., Far Tarn Fen, Malham, 25th July 1956.

P. anthrisci Hd.—Mines common in *Anthriscus sylvestris* (L.) Bernhardi., Scarcroft, near Leeds, June 1954.

P. atricornis Mg.—Mines common on *Sonchus* spp., Leeds, July 1954, on *Taraxacum officinale* Weber., Tarn Close, Malham, 24th July 1956. Adults reared from *Senecio jacobaea* L. taken at Scarcroft, near Leeds, on 30th August 1956. Emerged 6th, 7th and 9th September 1956.

P. calthivora Hd.—Larvae active in mines in *Caltha palustris* L. at Scarcroft Fish Pond, near Leeds, 5th July 1957. Adults emerged 21st, 22nd and 24th July 1957.

P. calthophila Hg.—Mines common in *Caltha palustris* L. in Tarn Fen, Malham, August 1955 and September 1957.

P. cirsii Hd.—Mines common in *Cirsium* spp. at Scarcroft, Colton and Aberford, near Leeds, during August 1957.

P. crassiseta Zett.—Mines in *Veronica* spp. at Bardsey, near Leeds, July 1956, and at Scarcroft, near Leeds, August 1957.

P. eupatorii Hd.—Mines in *Eupatorium cannabinum* L., Bardsey, near Leeds, August 1955.

P. ilicis Curt.—Very common and widespread in the Leeds area on *Ilex aquifolium* L. Adults often in small swarms around the food-plant.

P. lappina Gour.—Larvae active in mines in *Arctium* spp. at Scarcroft and Bardsey, near Leeds, during July and August 1956.

P. luzulae Hg.—Larvae active in mines in *Luzula* spp. at Scarcroft, near Leeds, June 1957.

P. matricariae Hd.—Mines in *Achillia millefolium* L., Thorner, near Leeds, September 1955.

P. minuscula Gour.—Mines common in *Aquilegia vulgaris* L. at Austwick, August 1954. Larvae active in mined garden plants of the same species, Leeds, June 1955.

P. nigra Mg.—A single specimen reared from an unidentified spp. of Grass taken at Scarcroft, near Leeds, on 8th September 1956.

P. obscura Hd.—Mines in *Mentha* spp. at Scarcroft, near Leeds, July 1956.

P. obscurella Fall.—Mines in *Aegopodium podagraria* L., Garforth, near Leeds, July 1956.

P. periclymeni de Meij.—Bred from mines in *Lonicera periclymenum* L., Roundhay Park, Leeds, and Scarcroft, near Leeds.

P. primulae R-D.—A fairly common miner of *Primula* spp. in the Leeds area.

P. ranunculi Schrk.—Mines frequently found in *Ranunculus* spp. Adults reared in July, August and September.

P. rufipes Mg.—Larvae active in mines in *Nasturtium* spp., Chapel Allerton, Leeds, June 1955.

P. rydeniana Hg.—Larvae active in mines in *Cirsium heterophyllum* (L.) Hill. near the Hill Inn, Chapel-le-Dale, July 1957. Adults emerged during August 1957. This interesting species should be searched for where Melancholy Thistle (*Cirsium heterophyllum* (L.) Hill.) grows, for it is specific to this plant.

P. sonchi R-D.—This species is frequently noted as mining the leaves of various *Compositae*. Adults have been taken during August and September at Scarcroft, Bardsey, and Thorner, near Leeds.

P. spondylii R-D.—Mines fairly common in *Heracleum sphondylium* L. at Scarcroft, near Leeds, during June 1954.

P. tanaceti Hd.—Mines in *Chrysanthemum* spp., Whitkirk, Leeds, August and September 1956.

P. taraxaci Hd.—Mines in *Taraxacum* spp., Garforth, Aberford and Whitkirk, near Leeds, July and August 1956.

References

Clapham, Tutin and Warburgh. Flora of the British Isles. 1952.

Frick, Kenneth E., 1952. A generic revision of the family Agromyzidae with a catalogue of New World species. *Univ. Calif. Publ. Ent.*, **8**: 339-452.

Hendel, F., 1931-6. Agromyzidae in Lindner. *Flieg. Palaeark. Reg.*, **59**: 1-570.

Hering, M., 1935-7. Die Blattminen mittel-und nord-Europas einschliesslich Englands. 1-631.

Hering, E. M., 1957. Bestimmungstabellen der Blattminen von Europa. I and III.

Kloet, G. S., and Hincks, W. D., 1945. *A Check List of British Insects*. Stockport.

Ryden, N., 1954. Catalogus Insectorum Sueciae. XIII. Diptera Cyclorrapha Schizophora: Agromyzidae. *Opuscula Entomologica*, **19**: 79-96.

Spencer, K. A. Observations of the British Agromyzidae (Diptera)—II. Records of Agromyzidae (Dipt.) in Scotland. *Ent. Gaz.*, 7: 51-4. 1956.

——— The British Agromyzidae (Dipt.). *Trans. S. Lond. Ent. and N.H. Soc.*, 1954-5 (1956).

The life history patterns of *Nebria degenerata* Schaufuss and *N. brevicollis* (Fabricius) (Coleoptera, Carabidae)*

By Owen Gilbert **

The Nature Conservancy, Merlewood Research Station,
Grange-over-Sands, Lancs.

Introduction

During a study of beetles occurring on duneland at Aberffraw, Anglesey, specimens of *Nebria degenerata* were found abundantly at some seasons, especially in low lying places. This population of *N. degenerata* was unmixed with its close relative *N. brevicollis* although this latter species occurred in nearby woodland. On the other hand, in the Roudsea Wood National Nature Reserve, North Lancashire, *N. brevicollis* occurs in large numbers unmixed with *N. degenerata*. Regular pitfall trapping, using 1-lb. jam jars sunk to their rims, has been carried out both at Aberffraw and at Roudsea and the results obtained reveal the basic life history patterns of the two species.

Results

In Table 1 the numbers of *N. degenerata* trapped in a level marram grass community are given. The traps were laid for one night only and the

Table 1

***N. degenerata* in pitfall traps at Aberrffaw. 60 traps for one night**

	Adults	Larvae		Adults	Larvae	
2. 8.51	0	0	1. 2.52	0	5	
3. 8.51	0	0	22. 2.52	1	11	(9 1L III.
4. 8.51	0	0	4. 3.52	0	0	2 1L II)
14. 8.51	0	0	27. 3.52	2 callows	1	(1L III)
6. 9.51	6	0	24. 4.52	4	0	
19. 9.51	24	0	8. 5.52	1	0	
28. 9.51	25	0	22. 5.52	3	0	
3.10.51	10	1	28. 5.52	0	0	
12.10.51	6	4	6. 6.62	0	0	
27.10.51	5	9	12. 6.52	0	0	
19.11.51	6	9	8. 7.52	0	0	
7.12.51	1	17	16. 7.52	0	0	
11. 1.52	1	9	5. 8.52	0	0	

captured animals released. The numbers of adults trapped shows a peak in September, following a period when they were totally absent from the traps.

* Roudsea Wood Nature Reserve. 5. ** United Steel Co. Ltd., Sheffield.

After September fewer adult beetles were captured although some persisted until February. Larvae were present from October to March. Pupation occurred in February or March, recently emerged adults with soft elytra being found at the end of March. After a period of spring activity the adult beetles disappeared, the absence of larvae during the summer months showing that the adults had not bred in the spring. Combining the results for the summers of 1951 and 1952 it is apparent that the adults become active again in the autumn when, as indicated by the larval data, they breed.

In Roudsea Wood pitfall traps were set in woodland growing on a slate-derived acid soil. *N. brevicollis* was more abundant there than on the adjacent woodland growing on base-rich soils. The traps were kept in place for one week. The results obtained show that the life history is basically the same in *N. brevicollis* as in *N. degenerata*. Larvae were not trapped in any numbers;

Table 2

***N. brevicollis* adults trapped in Roudsea Wood Nature Reserve. 10 traps for one week**

5-12. 8.55	0	5-12. 8.56	0
5-12. 9.55	3	5-12. 9.56	1
5-12.10.55	33	5-12.10.56	4
5-12.11.55	6	5-12. 1.57	2
5-12.12.55	4	5-12. 2.57	0
5-12. 1.56	0	11-18. 3.57	3
5-12. 2.56	0	8-15. 4.57	0
5-12. 3.56	4	13-20. 5.57	5 callows
5-12. 4.56	0	8-15. 7.57	0
5-12. 5.56	0	8-15. 8.57	0
5-12. 6.56	0	9-16. 9.57	35
5-12. 7.56	0	4-11.10.57	62

the few records show that they were found exclusively in autumn and winter. The adults had an autumn peak, and the callow adults appeared in May, by which time the old adults had disappeared. After a brief period of activity in spring adults were not trapped again until September. Some of the beetles in Roudsea Wood were dissected to obtain information on the state of the gonads (Table 3). The internal genitalia are similar to those of *Calathus* described by Gilbert (1956) except that the vasa deferentia are not lobed. The dissections showed that the adults captured in March, 1956, were old, presumably having been mature in the previous autumn. Unfortunately no females were available and so no data could be obtained on the corpora lutea. The callows obtained in May, 1957, all had immature gonads. The beetles obtained in the following autumn, however, were fully mature, with large ovaries and testes. The vasa deferentia were full of ropes of twisted spermatophores. The spermatophores of *N. brevicollis* are hyaline filaments,

contrasting with the ribbonlike structures found in *Calathus* and the lozenges found in *Carabus*. The male accessory glands were translucent after storage in alcohol and did not contain the chalky white material found in the accessory glands of *Calathus*. The accessory glands of immature *Nebria* were much smaller than those of the mature beetles.

Table 3

The internal genitalia of *N. brevicollis*

Date	Males			Females	
1957	Number dissected	State of vasa	State of accessory glands	Number dissected	State of ovaries
11-18 Mar.	3	Empty	Mature	0	—
13-20 May	1	Empty	Immature	4	Immature
9-16 Sept.	6	Full of spermatophores	Mature	8	Mature. Eggs present
4-11 Oct.	7	Full of spermatophores	Mature	7	Mature. Eggs present

Discussion

Both species of *Nebria* are autumn breeders and larval overwinterers, conclusions endorsing those of Larsson (1939) and Lindroth (1949). The emergence of callows from the pupal cells occurs somewhat earlier in *N. degenerata* at Aberffraw than in *N. brevicollis* at Roudsea Wood. Despite this difference, which may be due to climate, the emergence of the callows of both species is followed by their disappearance from the traps, presumably due to their inactivity. At Aberffraw extensive searching and trapping were carried out in nearby habitats to exclude the possibility of local migration. At both Roudsea and Aberffraw the traps caught large numbers of other beetles in the summer months when *Nebria* adults were absent.

From the data it appears that *N. degenerata* and *N. brevicollis* have an imaginal diapause in summer, during which time the gonads become mature. A diapause in adult insects is frequently a period of gonad maturation (Andrewartha, 1952). A similar period of summer inactivity involving the whole population occurs in *Carabus problematicus* Herbst (van der Drift, 1950). This beetle breeds in the autumn so presumably the inactivity is pre-reproductive and may therefore be a period of gonad maturation. In *Calathus mollis*, another autumn breeding carabid beetle found at Aberffraw (Gilbert, 1956), there is an interval of several weeks between emergence from the pupal cell and gonad maturity, during which time few recently emerged animals are trapped, suggesting a partial imaginal diapause in this species. The summer inactivity reported in *Carabus nemoralis* Müller (Delkeskamp, 1930) is post-reproductive.

Although a state of imaginal diapause is apparently rare in autumn breeding Carabidae, it is common among the other group, the spring-breeders, which overwinter as adults before breeding. Larsson (1939) divides the spring-breeders into two classes, those which pass the winter as adults within the pupal cell, and those which emerge from the pupal cell during autumn and then have a transient period of activity before entering their winter refuges. *N. degenerata* and *N. brevicollis* resemble this latter class except that, being autumn breeders, the life histories are half a year out of phase.

Summary

Both *Nebria brevicollis* and *N. degenerata* are autumn breeders and larval overwinterers. After the emergence of callow adults in the spring, both species have a summer imaginal diapause during which time the gonads mature.

My sincere thanks are due to Professor F. W. Rogers Brambell of the University College of North Wales, in whose department part of this work was carried out.

Literature cited

Andrewartha, H. G., 1952. Diapause in relation to the ecology of insects. *Biol. Rev.*, **27**: 50-107.

Delkeskamp, K., 1930. Biologische Studien über *Carabus nemoralis* Müller. *Zeitschr. f. Morph. u. Okol. Tiere*, **19**: 1-58.

Gilbert, O., 1956. The natural histories of four species of *Calathus* (Coleoptera, Carabidae) living on sand dunes in Anglesey, North Wales. *Oikos*, 7: 22-47.

Larsson, S. G., 1939. Entwicklungstypen und Entwicklungszeiten der dänischen Carabiden. *Ent. Medd.*, **10**: 277-560.

Lindroth, C. H., 1949. Die fennoskandischen Carabiden III. *Göteborgs VetenskSamh. Handl.* (B), **4** (3).

Van der Drift, J., 1950. Analysis of the animal communities in a beech forest floor. Wageningen, The Netherlands.

A FURTHER NOTE ON A *CHRYSOCHARIS* (HYM. EULOPHIDAE) PARASITIZING THE EGGS OF *DYTISCUS MARGINALIS* L., AND A COMPARISON OF ITS LARVA WITH THAT OF *CARAPHRACTUS CINCTUS* WALKER (HYM. MYMARIDAE)

By DOROTHY J. JACKSON

Introduction

In 1956 I recorded the rearing of a Eulophid from the eggs of *Dytiscus marginalis* L. Mr. G. J. Kerrich identified it as a species of *Chrysocharis.* I found the host eggs on *Juncus articulatus* L. in small artificial pools at Gilston, Largeward, Fife. These pools dried up in August, 1955, and I feared this would destroy the parasite, so I was very pleased to obtain further eggs there this summer containing the same parasite. Unfortunately the species again proved very difficult to rear. One of the eggs, collected on 17.6.57, contained 20 male and 4 female pupae, and another egg had 14, all male, pupae. Both these *Dytiscus* eggs were brown when collected. They were kept, unopened, in water, but about a week later both eggs had fungus mycelium growing out of them, and this was found to come from the pupae. I removed such pupae as still appeared healthy to sphagnum in a small dish of water, but all developed fungus.

Some of these pupae were mounted and the slides were sent to Mrs. F. L. Balfour-Browne of the British Museum (Natural History). She has most kindly examined the mand reports that the fungus is an *Achlya* sp.—almost certainly *A. flagellata* Coker, a member of the Saprolegniaceae. She informs me that these fungi are mostly saprophytes, occasionally facultative parasites, and that the insects are apparently generally dead when the fungi begin to develop on them.

On 31st July I revisited the same locality to collect shoots of *Juncus articulatus* growing under water to look for eggs of Dytiscidae. On bringing them home I noticed two small holes bored in a sheathing leaf in which a Dytiscus egg was embedded. The egg was discoloured and brown and showed two neat holes made by the emerging parasites. The egg still contained some imagines which I could recognize as probably being the Eulophid because of their iridescent colouring. I forwarded the host egg, intact, to Mr. Kerrich, so that he could confirm its identity. He extracted one of the parasites and was able to determine it generically as *Chrysocharis.*

I have at present three *Dytiscus* eggs, collected on 17.6.57, all with living larvae or pupae of this parasite. Since, as will be shown later, considerable confusion has arisen in regard to the Hymenopterous parasites occurring in *Dytiscus* eggs, I have extracted one full grown *Chrysocharis* larva to figure,

so as to show the great differences between this larva and that of the other, much commoner parasite of these eggs, *Caraphractus cinctus* Walker, a species which is also a common parasite of the eggs of *Agabus* and *Ilybius* (Jackson, 1956).

Larva of Chrysocharis

The full grown larva (fig. 2) is much larger than the mature larva of *Caraphractus* and it is entirely different in structure, possessing well defined

Fig. 2a

Fig. 1

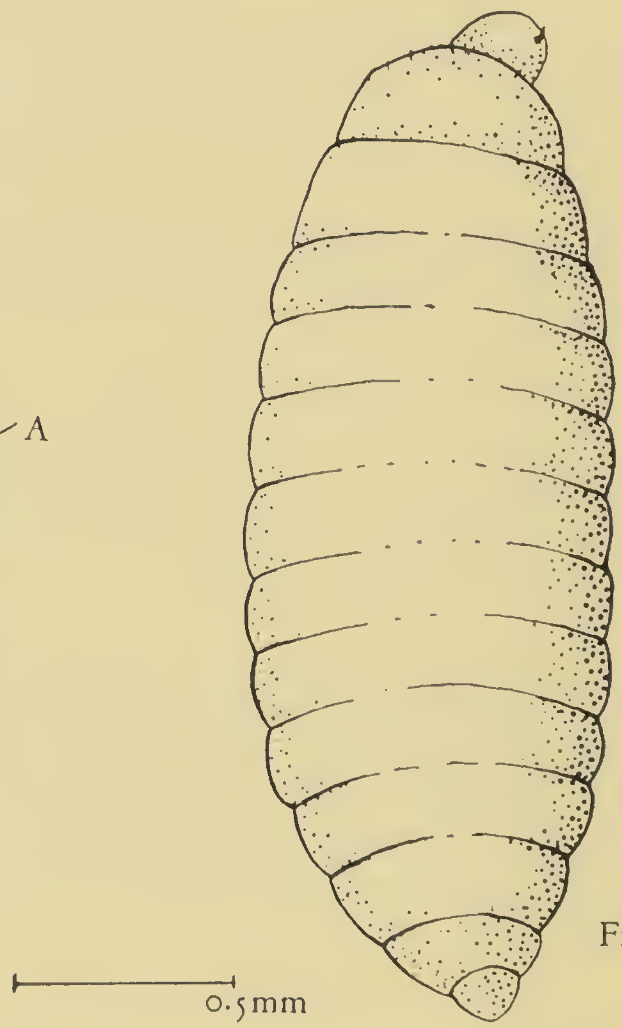


Fig. 2

Fig. 1. Egg of *Agabus bipustulatus* L. containing two full grown larvae of *Caraphractus cinctus* Walker. The shell of the egg is still surrounded in places with gelatinous cement. The larvae were viewed alive by transmitted light, so that the concretions in the mid-gut appear dark.

(A) Discoloured spot in shell of egg formed round oviposition puncture.

Fig. 2. Full grown larva of *Chrysocharis*, lateral view, sketched from living larva in Insect Ringer Solution. Same magnification as fig. 1.

Fig. 2A. Left mandible of full grown larva of *Chrysocharis*, ventral view.

segments. The small head is provided with sharp sclerotic mandibles (fig. 2A). There are thirteen body segments, as in the larva of *Chrysocharis laricinellae* Ratz., figured by Thorpe (1933). The cuticle is transparent and

the larva appears white owing to the presence of a great deal of fat-body, but I have not attempted to show any of the internal structures in the figure. Tracheae are present but are greatly obscured by the fat-body, but I could see in parts the longitudinal tracheal trunks of each side and some branches arising from it. I could find no spiracles either in the living larva or in various mounted larvae and I do not think they are present. Thorpe records seven pairs of functional spiracles in *C. laricinellae*.

Larva of *Caraphractus cinctus* Walker

This larva has been described and figured by Rimsky-Korsakov (1925) who has given some particulars of the internal anatomy. His paper which I have had translated is in Russian with a German summary. The following notes made from observations on living last stage larvae will serve to distinguish this species readily from *Chrysocharis*. The larva is best examined *in situ* in a small host egg such as *Agabus bipustulatus* L. (fig. 1) for if one tries to extract the larvae they usually burst or become distorted. Even if one does succeed in getting a larva out of the host egg undamaged, it readily floats to the surface of the water and there becomes flattened and distended. Examined under natural conditions in the transparent host egg, the larva is not visibly segmented and is widest at the head end. But the larval shape is continually changing because of the movements of the larvae relative to each other, and because of the peristaltic movements of the mid-gut. The cuticle is very delicate and transparent, so that the imaginal discs, especially those of the legs, can be seen readily. Apart from the soft rounded head, in which no mandibles could be discerned with certainty, and the very short hind-gut, almost the whole of the larva is occupied by the mid-gut which, in the larva before it enters into its prepupal rest, is continually in a state of motion, a peristaltic movement taking place from behind forwards and then from in front backwards.

Very conspicuous spots are present, in the region of the mid-gut, white by reflected light and dark by transmitted light (fig. 1). These spots consist of aggregates of small round spheres which are doubly refractile in polarized light with crossed nichols, and vary in size from 3 to 9 μ. Bakkendorf (1934) refers to these dark blotches in Mymarid and Trichogrammid larvae as "symbiotic cells." He states that these cells are placed in the walls of the stomach and are believed to contain micro-organisms. Rimsky-Korsakov (1925) refers to these objects as lumps of concretions in the mid-gut which become fused into a common opaque mass in the pupa, and he states that this mass is ejected from the gut by the imago after emergence. I have examined these aggregates in living larvae of *Caraphractus* mounted in the transparent host egg in water in an excavated slide. The opaque spots can be seen to move in all directions with the churning movements of the gut contents and this, at first, gives the impression that they lie free within the lumen of the mid-gut. However, with careful focusing, one can see, in the more transparent areas of the larva, that each aggregate is surrounded by

a clear circular cell wall, and I consider that these cells are situated in the delicate wall of the mid-gut as Bakkendorf states. In the living larva these aggregations may be seen drifting about beneath the fat body; they do not move in unison with the fat-body so cannot be located in the fat-body. Moreover, on extracting a larva from the host egg, the mid-gut is sometimes injured and collapses within the larva, expelling most of its contents, and contracting to about a quarter of its normal length; the cells with the opaque aggregations then become closely crowded together in the shrunken mid-gut wall, leaving the remainder of the larva clear and transparent. Again, if a larva is pricked so as to rupture the body wall only, the mid-gut wells out like a balloon from the aperture, bearing with it the conspicuous aggregations.

The aggregations are not noticeable in the newly hatched larva, and are very small in the young larva but they increase in size as the larva grows.

Rimsky-Korsakov (1925) states that two Malpighian tubules are present in the larva. I have not been able to see these in living larvae or in mounted larvae, though three short tubes attached to the posterior end of the mid-gut showed in one dissection. The presence or absence of Malpighian tubules could only be determined by study of sections. It is interesting to note that Tiegs (1922), in his fine paper on the post-embryonic development of the Chalcid, *Nassonia brevicornis* Ashmead, found Malpighian tubules absent in the larva, but he describes three digestive glands, "hepatic caeca" opening into the mid-gut posteriorly; two of them, which run along the sides of the mid-gut, he states have been erroneously interpreted as Malpighian tubules by other investigators of Chalcid larvae.

I have failed to find tracheae in the larva of *Caraphractus*, but they are present in the pupa.

The Prepupa

All the winter months are spent in the prepupal state within the host egg, but during the summer generations the prepupal stage is much shorter. It is distinguishable from the mature larva by the fact that the gut movements have ceased (though some movement may start with the heat of the microscope lamp), and the anterior and posterior extremities of the larva have become transparent, the mid-gut having contracted from either end. The opaque aggregations are larger than in the larva and extremely conspicuous (fig. 3) and the fat-body has become more distinct so that the outline of the cells can be seen. Each opaque aggregation consists, as in the larva, of spherical granules or concretions of varying size, some up to 18 μ in diameter (fig. 4). In the clear space between the granules and the margin of the cell, minute round particles in great numbers are in a state of constant agitation. I think these are granules in Brownian movement, suspended in the cell fluid before being deposited in the concretions.

The Pupa

In the pupa the aggregations have disappeared but an opaque yellowish mass of excrement is present in the abdomen. On dissecting a pupa the opaque matter gushed out from the gut and was found to be composed chiefly of the minute spheres. This is the meconium which is normally shed by the imago on emergence from the host egg. No solid waste matter is excreted by the larva.

The pupa of *Caraphractus* was figured in my previous paper and also the pupa of *Chrysocharis*; they are of entirely different shape and so are easy to distinguish.

On the probable nature of the aggregations in the larva and pupa of *Caraphractus*

The opaque aggregations present in the larvae and prepupa of this Mymarid are such a striking feature of this parasite that the briefest description of the immature stages would be incomplete without referring to them. As far as I know, apart from Rimsky-Korsakov's brief reference, no account has been published of these bodies in a Mymarid, and a full investigation of them based on sectioned larvae and pupae at all stages of development would be of much interest. My observations have been limited to the examination of living specimens, whole mounts and dissections, but from this study some deductions may be made. It seems very likely, as suggested to me by Dr. Salt, that these aggregations in *Caraphractus* may be of the same nature as the white spots so regularly present in Ichneumonid and Braconid larvae. In these larvae, however, the spots are situated in the copious fat-body surrounding the mid-gut. They are referred to by many writers as excretory or urate cells and they are believed to contain urate concretions. I have seen them in various larvae I have studied—in *Stenichneumon*, *Pimpla*, *Casinaria* (*Trophocampa*) and *Perilitus* (*Dinocampus*). They show very clearly in sections of *Stenichneumon trilineatus* Gmel. as large single cells amongst the fat-body, and they are larger and of different appearance from the fat cells or the oenocytes. They are well figured by Kuntze (1933). According to Schmieder (1928), in the Braconid, *Macrocentrus ancylivora* Rohwer, the urate granules remain in the excretory cells in the fat-body until the imago emerges, and, during the first day of the life of the imago—while it is still within the cocoon—the granules are transported in solution to the alimentary canal through the Malpighian tubules and voided through the anus. The urate cells thus serve to store up products of excretion before the Malpighian tubules are able to function. Berlese (1909) describes "le cellule uriche" in the fat-body of various Hymenopterous larvae, and he figures, on p. 791, one of these cells from the mature larva of a Cynipid. The cell (fig. 983) shows urate concretions which are exactly similar in appearance to the spherical concretions found in the *Caraphractus* larva.

The cells containing the aggregations in *Caraphractus* look very different from the urate cells in the fat-body in Braconid and Ichneumonid larvae since they are set in the mid-gut wall, and comparatively little fat-body is

present. No nucleus can be seen in these cells as they are so densely packed with concretions, only the peripheral area of the cell being transparent (fig. 3). The minute spheres may possibly be urate concretions (fig. 4). When the mid-gut epethelium of the prepupa degenerates during metamorphosis the concretions will become free in the lumen of the pupal gut (just as the degenerating mid-gut epethelium in *Nassonia* was found by Tiegs (1922) to be retained in the lumen of the pupal intestine) and the concretions are finally discharged by the *Caraphractus* imago in the meconium. The aggregations of spheres in the cells in the mid-gut wall of the *Caraphractus* larva will thus probably perform the same function as the urate concretions in other parasitic Hymenoptera.

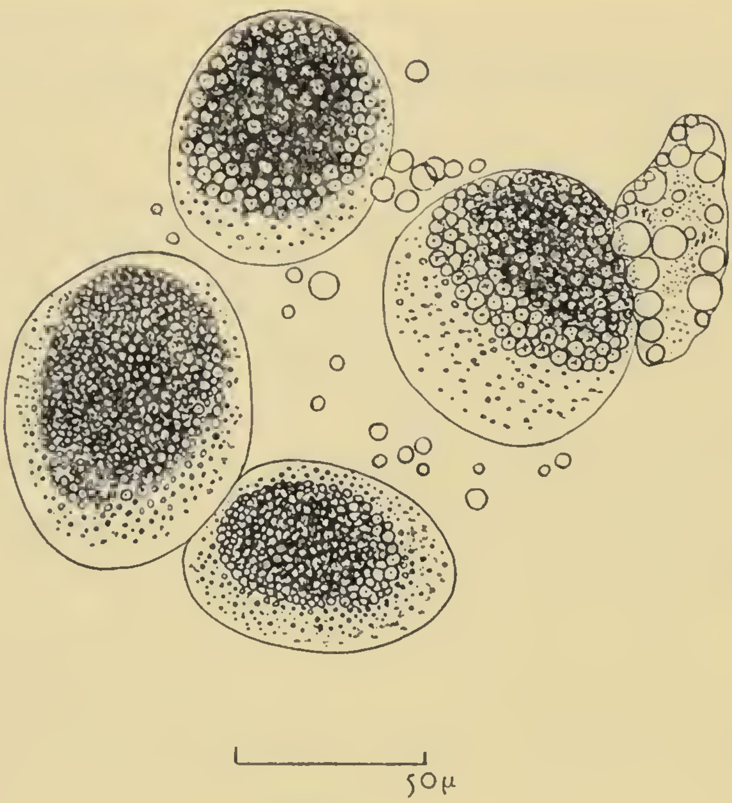


Fig. 3

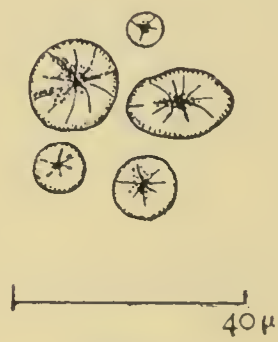


Fig. 4

Fig. 3. Cells with concretions from transparent wall of mid-gut of living prepupa of *Caraphractus cinctus*; the particles in peripheral area of cells are in constant movement. A single fat cell is shown and some free fat globules.

Fig. 4. Concretions from mid-gut cells of prepupa, after fixation with Carnoy and mounting in Euparal.

Similar concretions, brownish and differently placed, occur in the larva of *Chrysocharis*. In the few larvae I have been able to examine, all in the last instar, the concretions are not present in the fat-body, nor in individual cells in the mid-gut, but are closely packed into the lumen in the mid-gut so that the whole contents appear of an opaque brown colour. On pricking a last stage larva the mid-gut came out and was filled with these spheres. It would be interesting to know their position in younger larvae.

Parasite of Dytiscus eggs figured by Blunck

I have recently made the interesting discovery that the two pupae figured by Blunck (1914, p. 146), one in dorsal and one in ventral view, which he

obtained from *Dytiscus* eggs, and which he thought might be the pupae of *Prestwichia*, are exactly like my *Chrysocharis* pupae. The strong resemblance is at once noticeable on comparing his figure 30 (ventral view) with my figure 2 (Jackson, 1956). Moreover, I have compared the dorsal view of his figure 31 with living pupae of *Chrysocharis*, and his figure might have been drawn from my specimens!

Further evidence of the identity of his parasite with *Chrysocharis* is obtained by examining his figures of the larvae from which these pupae developed. The larvae he figures are segmented and possess mandibles and are of closely similar shape to the *Chrysocharis* larva, though in his figure only twelve body segments are shown instead of thirteen. He designates them as "(*Prestwichia* ?)" but they are certainly not *Prestwichia*, for Henriksen (1922), who has bred this species, figures and describes the larvae, and they show no segmental divisions and are sack-like. Korschelt (1924, p. 876) reproduces Blunck's figures of these larvae in the *Dytiscus* egg but he refers to them as "? (*Caraphractus* sp. oder *Anagrus* sp.)". These segmented larvae which Blunck figured are totally different from the larvae of *Caraphractus*, nor do they show any resemblance to the larva of *Anagrus brocheri* Schulz, a parasite of Agrionid eggs, which Henriksen (1922) figures in all its stages. Blunck was unable to rear his parasite from *Dytiscus* eggs and hence the misleading guesses as to its identity.

Korschelt, who reproduces most of the figures of aquatic Hymenoptera shown in Blunck's paper, does not, unfortunately, include Blunck's original figures of the very distinctive pupa, which I have only now seen. I think there can be no doubt that the parasite that Blunck figures, both in the larval and the pupal state, is the same parasite that I have reared and which Mr. Kerrich has determined as *Chrysocharis*. Blunck obtained the host eggs at Marburg in Germany in a shallow pond, rich in vegetation. This would suggest that a species of *Chrysocharis* is a widely spread parasite of *Dytiscus* eggs, though the other species of this genus are known to be parasites of leaf mining larvae, mostly Diptera.

Summary

A description is given of the larva of the Eulophid, *Chrysocharis* sp., and of the larva of the Mymarid, *Caraphractus cinctus* Walker. Both are parasites of the eggs of *Dytiscus marginalis* L. in Fife, but the larvae and pupae of the two species are easily distinguishable.

The full grown larva of *Chrysocharis* is much larger than that of *Caraphractus* and it is segmented and has well developed mandibles. The larva of *Caraphractus* shows no visible segmentation and no mandibles are apparent.

In the *Caraphractus* larva conspicuous opaque spots occur in the wall of the mid-gut. They consist of single cells, each containing numerous minute spheres, believed to be products of excretion. These spheres later become free in the gut of the pupa and are discharged in the meconium when the imago emerges from the host egg.

Blunck figured the larvae and pupae of a parasite from the eggs of *Dytiscus* in Germany but he failed to rear them. His species has been tentatively assigned to *Prestwichia*, *Caraphractus* or *Anagrus*, but it shows no resemblance to the larvae of any of these genera. The figures he gives closely correspond to the larvae and pupae of *Chrysocharis*.

References

Bakkendorf, O., 1934. Biological Investigations on some Danish Hymenopterous Egg Parasites, especially in Homopterous and Heteropterous Eggs, etc. *Entom. Medd. Kobenhavn*, **19**: 1-134.

Berlese, A., 1909. *Gli Insetti*, 1. Milan.

Blunck, H., 1914. Die Entwicklung des *Dytiscus marginalis* L. vom Ei bis zur Imago. I. Das Embryonalleben. *Zeitschr. f. wiss. Zool.*, **111**: 76-151.

Henriksen, K. L., 1922. Notes upon some aquatic Hymenoptera. *Ann Bio. lacustre.* Bruxelles. **11**: 19-37.

Jackson, D. J., 1956. Notes on Hymenopterous Parasitoids bred from Eggs of Dytiscidae in Fife. *J. Soc. Brit. Ent.*, **5**: 144-9.

Korschelt, E., 1924. *Bearbeitung Einheimischer, Tiere. Der Gelbrand Dytiscus marginalis* L., **2**. Leipzig.

Kuntze, R., 1933. Beitrag Zur mikroskopischen Anatomie der Ichneumoniden—Larven. *Bull. ent. Pologne*, **12**: 81-114.

Rimsky-Korsakov, M., 1925. (Ueber Wasser. Hymenopteren aus der Gattung. *Caraphractus* Haliday. In Russian, German summary.) *Travaux Soc. Nat.* Leningrad. **54**: 97-113.

Schmieder, R. G., 1928. Observations on the fat body in Hymenoptera. *Journ. Morph.*, **45**: 121-86.

Thorpe, W. H., 1933. Notes on the Natural Control of *Coleophora laricella*, the Larch Case-Bearer. *Bull. ent. Res.*, **24**: 271-91.

Tiegs, O. W., 1922. Researches on the Insect Metamorphosis, I, II. *Trans. Proc. R. Soc. S. Australia*, **46**: 319-527.

On the Pupa of *Spalgis lemolea* Druce (Lepidoptera, Lycaenidae)

By H. E. Hinton

(Department of Zoology, University of Bristol)

The pupae of three species of Spalginae, *Spalgis lemolea* Druce of Africa, *S. epius* Westw. of the Oriental Region, and *Fenisca tarquinius* F. of North America, have attracted a certain amount of attention because of their resemblance to an anthropoid's face. *Spalgis* pupates upon leaves, usually on the upper surface, or on twigs or branches. *Fenisca* has similar habits, but it may perhaps sometimes pupate among the loose leaves and twigs at the base of its host plant.

At a distance the pupa of *S. lemolea* may resemble bird excrement. There is nothing incompatable with such a supposition so far as its shape and colour are concerned. Indeed, Jackson (1937, p. 220) says, "The pupa is an interesting example of protective coloration. It is placed most conspicuously on the upper surfaces of the leaves and coloured in whites, greys and blacks to represent a bird-dropping, which it does exactly." A considerable number of insects and a few other arthropods are now known to resemble bird excrement. There is thus nothing exceptional in the suggestion made by Jackson (*op. cit.*) and Sevastopulo (preceding paper), and indeed in Britain a number of moths as well as the early larval instars of *Apatele alni* L. and the pupa of *Strymonidia pruni* L. resemble bird excrement.

The figure of *Spalgis lemolea* given by Holland (1892) and reproduced by me (Hinton, 1951, 1955) is not a very good likeness. Nevertheless, in certain lights the pupa does resemble the figure given by Holland, but is less like a chimpanzee than his figure would have it. I have recently been able to examine five specimens of *S. lemolea* through the kindness of Mr. W. H. T. Tams, and, although there is much variation amongst them, they all bear a resemblance to one or other species of *Cercopithecus*. The pupae seen by me are nowhere chalky white, and their colour is not unlike, for instance, that of *Cercopithecus patus*. Their resemblance to species of *Cercopithecus* is altogether better than would appear from the photographs reproduced here.

There seems to be no theoretical or other reason why the pupae should not at a distance resemble bird excrement and nearby a monkey's face.

A high proportion of insectivorous birds hunt by the method of "rapid peering"; they peer at objects from several different angles in rapid succession. Their binocular field is probably usually so narrow as to be of little practical importance, and perception of solidity and distance is gained by invoking parallax. But with birds, as with us and other vertebrates, the apparent distance of a familiar object is determined by the size of its image upon the retina. The method of rapid peering of insectivorous birds is going to mean that from time to time a bird will suddenly have a close up frontal view of a *Spalgis* pupa.

If we are able to assume that a monkey's face, and perhaps even that of the common *Cercopithecus*, is familiar to some of the birds of the region, only one further assumption is required for what is now postulated: that is, that to some birds the pupa sufficiently resemble a monkey so that at least in a small percentage of instances avoiding action is taken with the result that the pupa escapes attack.

The theory postulated here hinges on the second assumption since no one is likely to quarrel with the first. Similarly, no one is likely to dispute the further assumption so far only implicit in the argument: that many or at least some insectivorous birds take avoiding action when suddenly confronted with a monkey.

The assumption that the pupa sufficiently resembles a monkey to be occasionally taken for one at close range by some insectivorous bird is an assumption that can be put to the test by someone in the region where *Spalgis* occurs. It may be mentioned here that the pupa has been presented to about two dozen entomologists, including some who were experienced field naturalists, and the great majority supposed that it resembled a monkey's face: no one suggested a resemblance to bird dung, probably because they were peering at it too closely, often with the aid of a hand lens.

One of the chief arguments for the view that the resemblance of the pupa to a monkey is accidental is based upon the difference in size between the two (the pupa is only 4.5-6.5 mm. long), but we have already seen how the method of feeding of many insectivorous birds is such that the image of the pupa can suddenly occupy an appreciable part of the retina. The same considerations would apply to the remarkable resemblance of the South American *Laternaria* (Hemiptera, Fulgoridae) to the head of alligators of the genus *Caiman*.

Even when the predator is aware of the discrepancy in size between model and mimic, it does not necessarily follow that the resemblance has no selective value for the mimic. Sometimes we can ask the predators what they think about it. For instance, as has been noted by Neave (1905) and others, in certain parts of Africa there are tribes of natives that eat *Sphingid* larvae and pay so much attention to them that they have their special names for the various kinds that they eat. Yet, when these natives are presented with a *Choerocampa* they mistake the thoracic spots for real eyes and believe the larva to be a snake: they are terrified of a larva that is the same size and practically identical in structure to larvae they normally go to some trouble to find and eat.

Current interpretations of the significance of many of the colour patterns and superficial structures of insects not only depend upon the assumption that vertebrates, and especially birds, are important enemies, but also upon the further assumption that the discriminative capacity of these predators is adequate to bring about the selective pressure that results in resemblances so perfect to the human eye as to be a constant source of astonishment and delight or to simple piety confirmation strong as proofs of holy writ of the

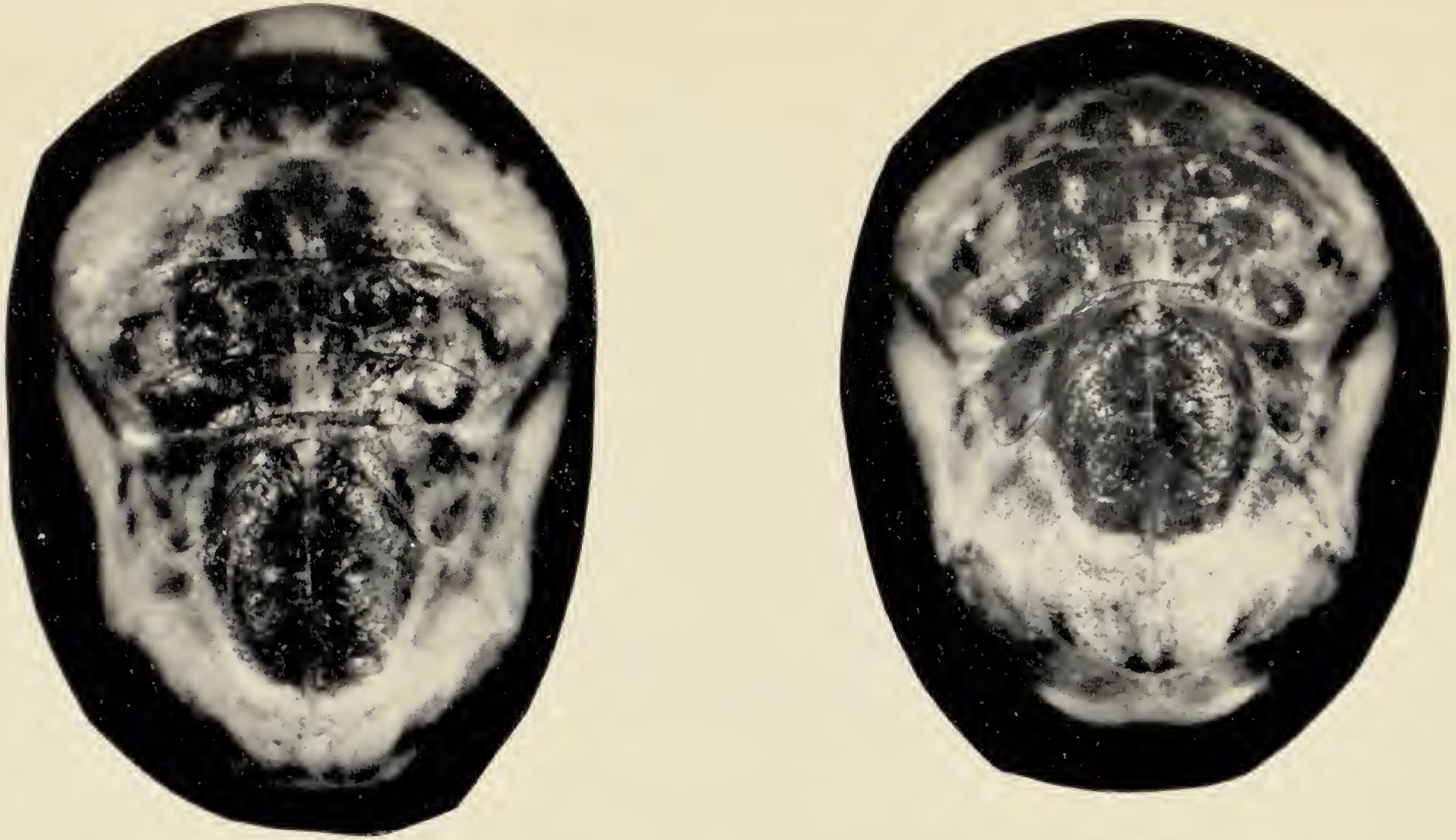


Plate I

Figs. 1-2. *Spalgis lemolea* Druce. Two different frontal views of the same large pupa.

Plate II

Fig. 3. *Spalgis lemolea* Druce. Frontal view of a small pupa.

immediate intervention of God. There is a growing body of experimental evidence that amply substantiates the assumptions noted above, as, for instance, the work of Ruiter (1952) on the resemblance of Gemoetriid larvae to sticks.

The more that we experiment with and know about the form and structure of animals the less are we able to attribute to "accidents." The Japanese crab *Dorippe japonica* resembles one of the Samurai. It is edible, but it is not eaten. It has often been cited as a clear instance of a purely fortuitous resemblance, but Huxley (1957, p. 138) has this to say of it: "The resemblance of *Dorippe* to an angry traditional Japanese warrior is far too specific and far too detailed to be merely accidental: it is a specific adaptation which can only have been brought about by means of natural selection operating over centuries of time, the crabs with more perfect resemblances have been less eaten."

I have not seen specimens of *Spalgis epius* nor of *Fenisca*. The drawing of *S. epius* given by Aitken (1894) and reproduced by me (Hinton, 1951, 1955) closely resembles the species of *Macaca* of its region, perhaps especially the common rhesus macaque. It seems too much to attribute to coincidence the fact that the Oriental pupa looks like a common Oriental type of monkey* and the African pupa like a common kind of African monkey.

According to the illustrations that have been given of *Fenisca*, this species has an unmistakable resemblance to an anthropoid. It could be said to resemble some of the species of Cebidae with a wide, straight mouth or a Red Indian. Against the view that it has been selected to resemble a species of Cebid is the fact that the few recent Platyrrhini that have migrated from South America are confined to Central America. The only fossil anthropoid known from North America is *Homo sapiens americanus* L. The latter is known from the Pleistocene of North America, and not only was it until very recent times the only anthropoid found throughout the range of *Fenisca*, but it is a species known to have preyed upon birds.

References

Aitken, E. H., 1894. The larva and pupa of *Spalgis epius* Westwood. *J. Bombay nat. Hist. Soc.*, **8**: 485-7, 2 pls.

Hinton, H. E., 1951. Myrmecophilous Lycaenidae and other Lepidoptera—a summary. *Proc. S. Lond. ent. nat. Hist. Soc.*, **1949-50**: 111-75, 9 figs.

——— 1955. Protective devices of endopterygote pupae. *Trans. Soc. Brit. Ent.*, **12**: 49-92, 23 figs.

Holland, W. J., 1892. The life-history of *Spalgis s-signata* Holl. *Psyche, Camb. Mass.*, **6**: 201-203, 1 pl.

Huxley, J., 1957. *New wine in new bottles.* London.

Jackson, T. H. E., 1937. The early stages of some African Lycaenidae (Lepidoptera), with an account of the larval habits. *Trans. R. ent. Soc. Lond.*, **86**: 201-38.

Neave, S. A., 1905. [No title.] *Proc. ent. Soc. Lond.*, **1905**: xxiii.

Ruiter, L. de, 1952. Some experiments on the camouflage of stick caterpillars. *Behaviour*, **4**: 222-32, 4 figs.

* It is, of course, possible that the figure given by Aitken greatly overstresses the resemblance of *S. epius* to *Macaca*. There is an African species of *Macaca*, but it is confined to North Africa (Morocco, Algeria), and no species of *Macaca* is found in the regions inhabited by *S. lemolea*.

An arctic *Spilogona*, new to Britain, on Ben Lawers (Diptera, Muscidae)

By C. H. Andrewes, M.D., F.R.S.

Ben Lawers in Perthshire is well known as a locality for rare alpine plants; it is very gratifying to find that it harbours at least one unusual species of fly. I went up the mountain from Killin on 26th June, 1957, on a sunny day with only moderate wind. On the final 500 feet of the ascent I saw a number of small flies sunning themselves on stones but very agile and hard to net. I caught two, one of them being spoilt, but I could not readily examine them on the spot, so did not realise till I returned to Killin that I had something unusual.

Mr. J. E. Collin kindly identified my good specimen, a male, as *Spilogona alpica* Zett. He has described it in his account of some Greenland flies (1930) and tells me that besides Greenland, it is known from Jan Mayem Island and mountains of Scandinavia.

Spilogona alpica is a small bluish-grey species, only 3·5 - 4 mm. long. The arista is very shortly pubescent, the theca of the proboscis mostly dusted, *eyes widely separate*. There are usually only three posterior dorso-central bristles, no posterior one on front tibia, one to two anterior and two posterior on mid-tibia. The mesonotum is uniform blue-grey, practically unstriped. The abdomen is blue-grey with darker brownish basal patches; in my specimen there is even a suggestion of greenish-brown on violet-blue.

It is interesting to speculate on whether such a species, not previously recorded from Britain, is a relic of a bygone fauna.

The specimen described has been given to the National collection at South Kensington.

Reference

Collin, J. E., 1930. *Trans. R. ent. Soc. Lond.*, 78: 255.

A comparison of the nymphs of the British species of the genus *Ephemera*

by T. T. Macan

Freshwater Biological Association, The Ferry House, Ambleside, Westmorland

Kimmins (1954) lists: *Ephemera vulgata* Linnaeus, 1758,
E. danica Müller, 1764,
E. lineata Eaton, 1870.

The nymphs of the first two have been distinguished by Petersen, whose paper I have not seen, Lestage (1916), Schoenemund (1930) and Percival and Whitehead (1926), that of the last is undescribed. The English and German authors have added little original to the full description given by Lestage and have been content to confirm the differences that he noted. They are:

	E. danica	*E. vulgata*
Head markings	joined together	not joined together
Sides of head	less convex	more convex
Clypeal projection	sides rather convex, front embayed, projections rather obtuse	sides nearly straight,* front more deeply embayed, projections distinctly sharper
Abdominal markings	on segments 6-9 a broad dark stripe and a narrow line inside it; on other segments markings frequently absent, and small and obscure when present.	on segments 2-9 a dark comma-like mark, with, on segments 7-9, a narrow line inside it.

* In Percival and Whitehead's figure, which is "from Lestage after Petersen," they are concave.

The first character is worthless in my experience as the pattern varies considerably. The second character is not to be found in Schoenemund's key nor is the difference categorically stated by Lestage, who merely asserts that the head of *E. vulgata* is round at the sides and makes no mention of the condition in *E. danica*. Percival and Whitehead were, I think, justified in concluding from his drawings that Lestage recognised this as a distinction. It is, however, a second worthless one, for the eye of the male is larger than that of the female and its size appears to increase as the time for metamorphosis draws near. Fig. 1: 1, 6, and fig. 1: 2, 8, show heads of nymphs of the two species taken in December; the eye of *E. danica* is longer, that of *E. vulgata* is broader and slightly more protuberant. Fig. 1: 3, shows the eye of a nymph of *E. danica* taken in May; it is distinctly more protuberant than that of *E. vulgata* taken in December. The specimens came from different places and the conjecture that the eye increases in size in the final instar needs further investigation but it may be said with confidence that the character cannot be used to distinguish the species.

The third character is more reliable but not nearly as clear as the illustrations in the three works quoted give one to believe, as the shape varies. Fig. 1: 1, 3, 4, 6, 7, show the clypeal process in *E. danica*; 4 shows an extreme example of convexity and it resembles the figures mentioned; 1 shows a more typical specimen, and 3 and 7 two in which the sides are as straight as in *E. vulgata*. There is a tendency for the sides of the projection to be more convex in the female than in the male; 7 shows a specimen in which the frontal bay is unusually shallow. Fig. 1: 2, 5, 8, show the process in *E. vulgata* in which it may be seen that, though the degree of convexity of the sides is not a reliable criterion, the frontal bay is deeper and wider and the lateral projections sharper in consequence. *E. lineata* is somewhat intermediate between the two.

The last character provides an excellent distinction, though there is the disadvantage that, as Schoenemund also notes, the pattern eventually disappears in preservative. Schoenemund makes in his key the qualification that the pattern distinguishes only older nymphs, Percival and Whitehead could tell apart nymphs down to 12·5 cm long, and I have examined nymphs of *E. danica* down to 5 cm long and still found the characteristic pattern.

Schoenemund's forecast that the nymph of *E. lineata* will prove to have the distinctive markings of the adult, as the other two have, is correct. The six narrow lines (fig. 2: L) are characteristic, though it should be noted that the broad triangular mark on *E. danica* (fig. 2: D) may be divided by a lighter line, giving a total of six dark marks on the whole tergum. They are not, however, as linear as those of *E. lineata*.

Careful examination has revealed only one character not mentioned by earlier workers. The fore tibia of *E. danica* is broad and its convex side is evenly rounded (fig. 3: D), that of *E. vulgata* (fig. 3: V) is narrower and the sides are straighter. The tibia of *E. lineata* is like that of *E. danica* but the femur is broader (fig. 3: L) than that of either of the other two species. The mid-tibia shows the same difference even more clearly.

These findings may be summarized in a key:

1. A distinct dark mark on all the abdominal terga except the first and last, those on segments 7, 8 and 9 barely twice as big as those on other segments (fig. 2: V). Fore tibia relatively narrow, bounded on the inner side by two straight edges joined by a curve (fig. 3: V). (Fore femur relatively narrow (fig. 3: V). Clypeal process with very slightly convex sides, a deep wide frontal bay and rather sharp forward projections (fig. 1: 2, 5, 8)) .... *vulgata*

— On abdominal terga 7, 8 and 9 the dark area is large, whereas on segments 3 and 4 at least it is small, obscure and often absent (fig. 2: D, L). Fore tibia broader and with the whole of the inner margin curved (fig. 3: D, L) 2

2. A large triangular mark on abdominal terga 7, 8 and 9; it may be divided into two and there is a narrow line inside it (fig. 2: D). Femora relatively narrow (fig. 3: D). (Clypeal process may have sides more convex than those of *vulgata*, the frontal bay is smaller and the forward projections more obtuse, fig. 1: 1, 3, 4, 6, 7) .... *danica*

— Three dark lines on abdominal terga 7, 8 and 9 (fig. 2: L). Femora broader (fig. 3: L) .... *lineata*

The following material was examined:

E. vulgata: 1 cast skin from Bottisham Lode, CB; 15 whole nymphs from the Kennet-Avon canal near Reading, BK. I am greatly indebted to Dr. K. H. Mann, who made a special collection for me in the canal.

E. danica: 2 cast skins and 12 whole nymphs from Windermere, WL; 5 whole nymphs from Bassenthwaite, CU; 1 whole nymph from the Kendal-Lancaster canal; 10 whole nymphs from Dodnash Stream, ES; 8 cast skins from R. Darent, WK; 4 cast skins from Tillingbourne, SR; 2 whole nymphs from Kennet-Avon canal near Reading, BK; 3 cast skins and 1 whole nymph from L. Sheelin, CV.

Ephemera lineata: 10 whole nymphs sent to me from Poland by Dr. Maria Keffermüller, whom I thank most sincerely.

This species was taken by Eaton near Reading, and there are subsequent records from three places lower down the Thames, but the most recent is 1902.

References

Kimmins, D. E., 1954. A revised key to the adults of the British species of Ephemeroptera. *Sci. Publ. Freshwat. biol. Ass.*, No. 15.

Lestage, J.-A., 1916. Contribution a l'étude des larves des éphémères paléarctiques. *Ann. Biol. lacust.*, **8**: 244-253.

Percival, E., and Whitehead, H., 1926. Observations on the biology of the mayfly, *Ephemera danica*, Müll. *Proc. Leeds phil. lit. Soc.*, **1**:136-148.

Schoenemund, E., 1930. Eintagsfliegen oder Ephemeroptera in *Die Tierwelt Deutschlands*, Teil 19.

Figures

1. Heads of *danica* (1, 3, 4, 6, 7) and *vulgata* (2, 5, 8):

 1. *danica* ♀ from Dodnash stream, 23 mm. long.
 2. *vulgata* ♀ from Kennet-Avon canal, 24 mm. long.
 3. *danica* ♂ from Dodnash stream, 15 mm. long.
 4. *danica* ♀ from Windermere, 23 mm. long.
 5. *vulgata* ♂ from Kennet-Avon canal, 18 mm. long.
 6. *danica* ♂ from Windermere, 15 mm. long.
 7. *danica* ♀ from L. Sheelin, 20 mm. long.
 8. *vulgata* ♂ from Kennet-Avon canal, 18 mm. long.

 Scale line is 1 mm. long.

2. Dorsal pattern on abdomen of:

 V, *vulgata* ♂ from Kennet-Avon canal, 16 mm. long.
 D, *danica* ♀ from Windermere, 15 mm. long.
 L, *lineata* ♂ from Poland, 15 mm. long.

3. Anterior or inside surface of front leg of:

 V, *vulgata* ♂ from Kennet-Avon canal, 16 mm. long.
 D, *danica* ♂ from Windermere, 15 mm. long.
 L, *lineata* ♀ from Poland, 15 mm. long.

 Scale line is 1 mm. long.

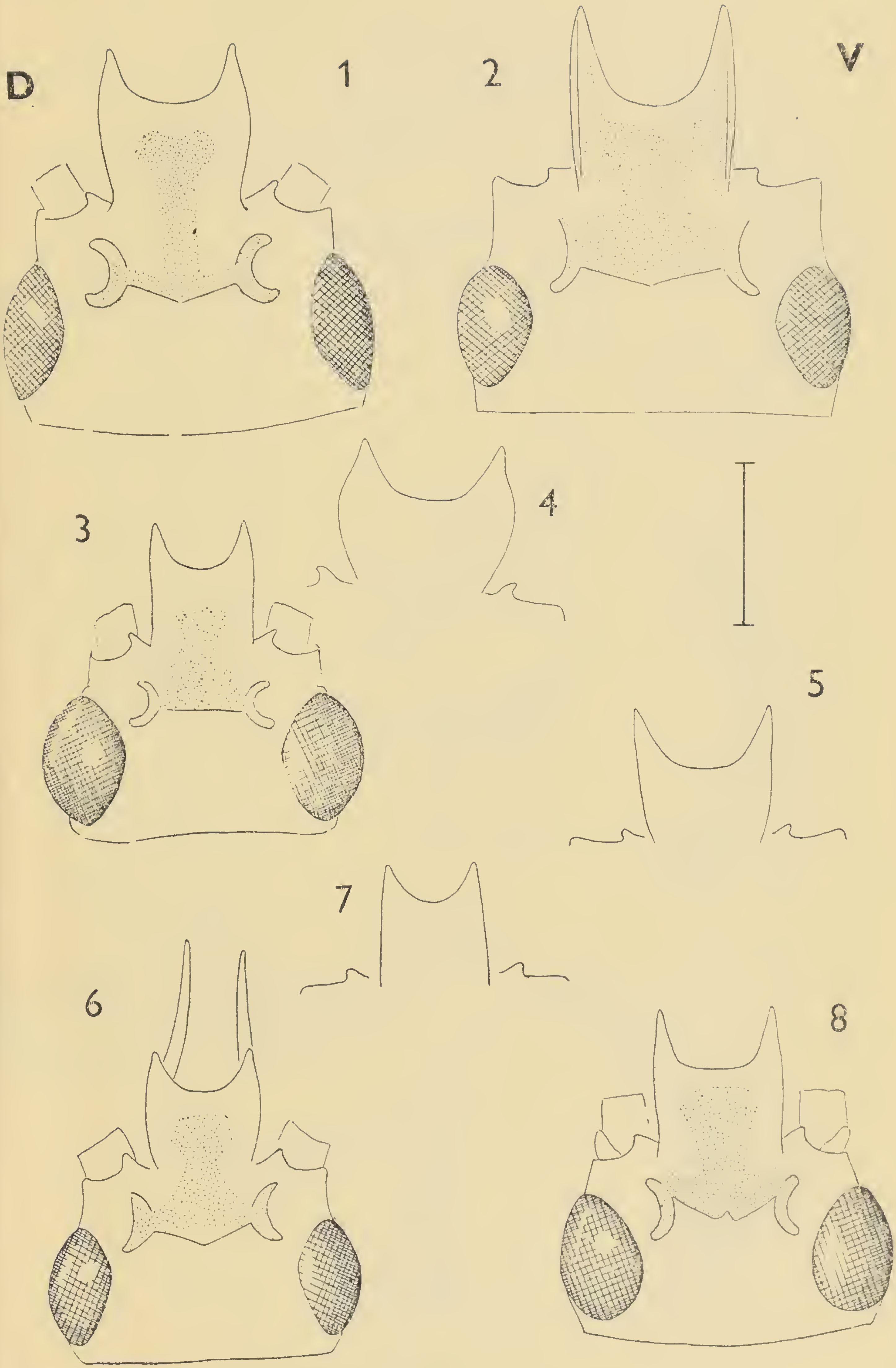


Fig. 1.

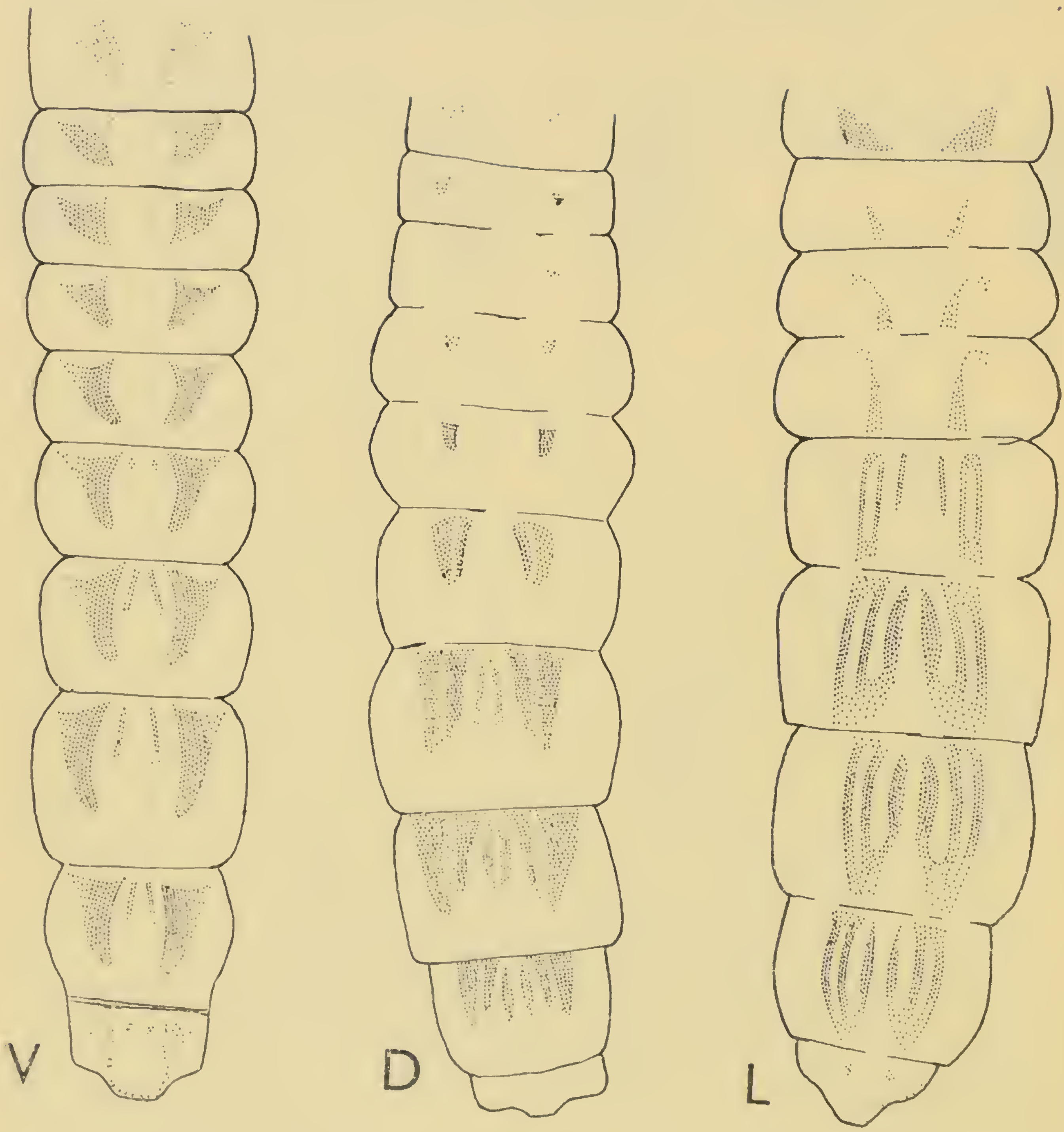


Fig. 2.

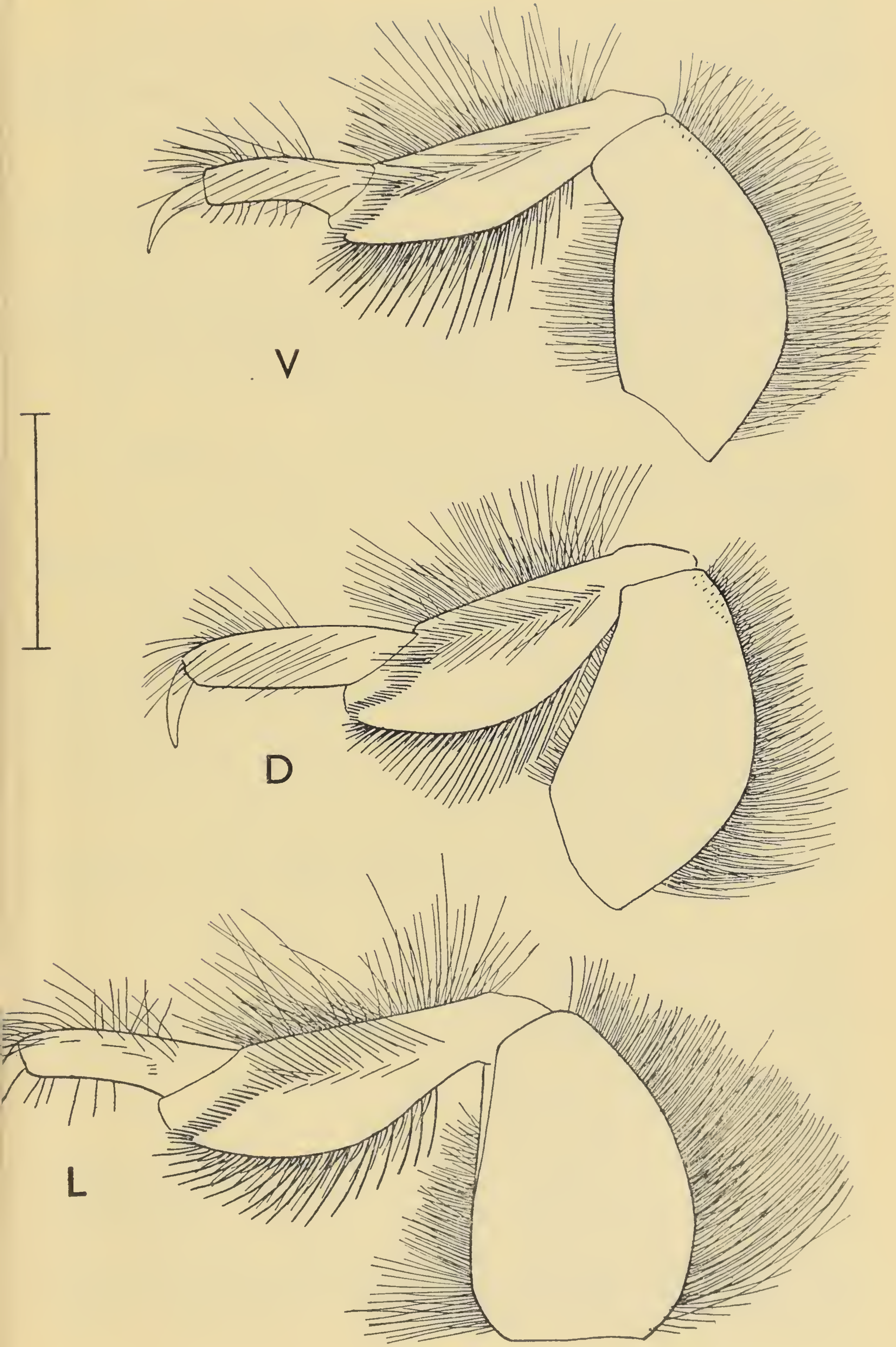


Fig. 3.

Reviews

A. D. Imms **Ninth Edition**

A General Textbook of Entomology

Entirely revised by Prof. O. W. Richards and Mr. R. C. Davies

Methuen, London **Price 75s.**

Since its first appearance in 1925 Imms General Textbook of Entomology has been one of the standard reference books on the subject. Although Imms revised the work on several occasions during his lifetime rapid advances have made some sections out of date for nearly a quarter of a century and a thorough revision has therefore been needed for some time. This task has now been completed by Prof. O. W. Richards and Mr. R. C. Davies.

The whole book has been re-set and given an attractive modern format. New diagrams have also been added and the length increased from 702 to 866 pages.

The section on insect anatomy retains much of its original form, but new sections have been added on the structure of the insect cuticle, wing coupling, wing development, flight and muscle histology. Recent advances on hormones have made it necessary to add a useful section on endocrine organs.

Advances in insect physiology have made it necessary for this section of the book to be largely re-written and, in accordance with previous tradition, from the anatomical viewpoint; details of physiological and biochemical processes being left for more detailed treatment elsewhere. The revisers have as a general principle wisely made no attempt to review the literature since 1952, and it is inevitable, therefore, that some of the sections on physiology are rapidly becoming obsolete.

The greatest changes are to be found in the sections on systematic entomology, where 120 new pages have been added. The systematics of some orders, or sections of them, are still imperfectly known or are still in a state of flux. The revisers have, therefore, prudently adopted a conservative policy and little revision has been made until a revision of the world's species is available. If in places one feels the reviewers have been too cautious one cannot but admire the scholarly restraint with which the book as a whole has been revised. Nowhere does the revision adopt an extreme viewpoint and where possible the safe via media has been adopted. Thus, the Diplura, Grylloblatoidea, Phasmidae and Dictyoptera are now raised to ordinal rank, but the Strepsiptera is not included amongst the Coleoptera as some modern authorities would suggest. Although Martynov's classification has not been adopted as such, the Exopterygote orders are arranged in accordance with his ideas. Thus the Ephemeroptera and Odonata now come before the Orthoptera, instead of after them as in the eighth edition. The Endopterygote orders of Tillyard's Panorpoid complex are grouped together and are followed by the Hymenoptera and Coleoptera, whereas in the eighth edition these two orders appear somewhat illogically between the Lepidoptera and Diptera.

The section of the eighth edition on various systems of classification have been omitted and replaced by a useful review of the evolution of insects as shown by the geological record. The accounts of the biology of the various families of insects has been greatly extended and modernised.

Other improvements are the standardisation of the nomenclature, while the large number of references have been edited, checked and augmented.

It was no small achievement for the late Dr. Imms to write such a comprehensive treatise on entomology, but it is perhaps no less an accomplishment to modernise the work without losing its traditional form or high standard. Yet the ninth edition has not only come from the hands of the revisers much as Imms might have wished it, but they have also made it one of the finest modern reference books on entomology in any language.

The revisers deserve both our congratulations and gratitude.

H. B. N. Hynes

A Key to the Adults and Nymphs of British Stoneflies (Plecoptera)
Freshwater Biological Association Scientific Publication No. 16

89 pages **Price 5/6**

Dr. Hynes key to the British Stoneflies is partly a revision of a similar publication which appeared in 1940. The introductory section has been enlarged to give a good general account of the external morphology of both adult and nymph as well as of their general biology. They keys to adults have been revised and enlarged in the light of modern research and readers will welcome the detailed keys to the nymphs over 5 mm. in length based upon Hynes paper of 1941. Details of the distribution of each species are now given as a series of maps. These publications are intended to enable both amateur and professional entomologists identify freshwater insects. Dr. Hynes revised keys will serve this function with efficiency, but the booklet as a whole cannot fail to stimulate a much greater interest in this interesting, but somewhat neglected, order.

Sale of previous volumes of the *Journal*

A limited number of previous volumes of the *Journal* are available for purchase at approximately 50% published price, as follows:

	Published price £ s. d.		*Revised price* £ s. d.
Vol. II (2 - 7)	1 0 0	..	10 0
Vol. III (1 - 6)	1 19 0	..	1 0 0
Vol. IV (1 - 9)	2 1 6	..	1 5 0
Vol. V (1 - 7)	2 15 0	..	1 10 0

These volumes may be purchased on application to the Publications Secretary, Department of Entomology, The Museum, Manchester 13.

Eleventh Congress of British Entomologists
Oxford, July 3rd-6th, 1959

By kind invitation of Professor G. C. Varley, the Eleventh Congress of British Entomologists to be organised by the Society for British Entomology, will be held at Oxford on 3rd to 6th July, 1959. Like its predecessors, this congress will be open to the participation of any person interested in entomology. Members of the Society and of the Trust are asked especially to note these dates. Accommodation will be at Jesus College, Oxford. The local organiser, Dr. M. W. R. de V. Graham, Hope Department of Entomology, University Museum, Oxford, will be pleased to answer enquiries, and to send a full programme, when ready, upon request.

Eleventh International Entomological Congress
Vienna, August 17th-25th, 1960

From 17th to 25th August, 1960, there will be in Vienna the ELEVENTH INTERNATIONAL ENTOMOLOGICAL CONGRESS. Those who are interested and have not yet received a circular letter about the Congress are asked to write to the Secretary's Office, Vienna I, Burgring 7, as soon as possible. Further information will be sent on application.

R. W. LLOYD, F.R.E.S.

Just before going to press we have learned with deep regret of the death of Mr. R. W. Lloyd, the well known entomologist, collector, benefactor and foundation member of the British Trust for Entomology. A suitable obituary notice will be published in the next issue of the *Journal*.

SOCIETY FOR BRITISH ENTOMOLOGY

All official correspondence should be sent to the Secretary of the Society

All applications for membership should be made to the Hon. Treasurer

Editorial communications should be sent to:

E. J. POPHAM
DEPARTMENT OF ZOOLOGY, THE UNIVERSITY, MANCHESTER 13

The author of any published paper shall, *if he so request at the time of communicating such paper*, be entitled to receive twenty-five copies thereof gratis

Information regarding the Society may be obtained from the Secretary

CONTENTS

Printed by SYDENHAM & Co. (Est. 1840) LTD., Printers, Oxford Road, Bournemouth

VOL. 6

PART 2

JOURNAL
OF THE
SOCIETY FOR BRITISH ENTOMOLOGY

World List abbreviation: *J. Soc. Brit. Ent.*

DATE OF PUBLICATION: 27TH MAY, 1959

Copies may be purchased from the Publications Secretary, Department of Entomology, The Museum, Manchester, 13

Price 17s. 6d. post free

Published for the Society by the British Trust for Entomology Ltd.

BRITISH TRUST FOR ENTOMOLOGY LTD.

41 QUEEN'S GATE, LONDON, S.W.7

All official correspondence should be sent to the Secretary of the Trust

JOURNAL OF THE SOCIETY
FOR BRITISH ENTOMOLOGY

VOL. 6 27th MAY, 1959 PART 2

THE HABITATS AND DISTRIBUTION OF BRITISH *GERRIS* AND *VELIA* SPECIES

By R. O. BRINKHURST
(Department of Zoology, Liverpool University)

The following paper consists of data on the habitats and vice-county distribution obtained during a study of alary polymorphism in the Gerroidea (Brinkhurst 1959a).

Velia caprai Tam.

This species is predominantly a stream inhabitant and is taken only occasionally on ponds or pools, or beneath stones. Popham (1945, 1949) showed that *V. caprai* (as *V. currens*) was often abundant where there were eddies in the stream, or where the water was overhung by vegetation. The species was often found in my surveys beneath tree-roots projecting into the stream. Autumn and spring captures of these insects beneath stones close to the water's edge indicate that they overwinter in these situations, unlike macropterous species which usually fly far from water.

An intermittent stream at Belfairs, Leigh-on-Sea, supported large populations in three successive years, suggesting that, whilst swiftly flowing water is the normal habitat, it is not essential.

The distribution map shows this species to be pan-British although it has not been recorded for many Midlands counties.

Velia saulii Tam.

Prior to the publication of a paper by Brown (1954) this species was known only from Cumberland, Westmorland, Yorkshire (mid-west), Elgin and Easterness. In that paper, Brown confirmed his earlier opinion that *V. saulii* inhabited larger, more open bodies of water than *V. caprai*. All records now obtained are from lake shores or large streams and rivers, and in each case the adults were found beneath stones. Nymphs were seen running free on the water, but not adults. Flint (1956) cited additional Yorkshire records and stated that "the only features that the various *saulii* habitats had in common was the presence of almost vertical banks to the water, clay, stone or brick-work devoid of any vegetation." He also described a method by which male *Velia* could be identified in the field, namely the size and shape of the dark marks on the laterotergites, smaller and triangular in *caprai*, larger and nearly square in *saulii*. This character has proved reliable.

It is thus clear that there are other types of habitat than those described in Table 1, but it is still probable that if more attention were given to searching under stones this species would be commoner than supposed.

Gerris najas Deg.

Gerris najas is widely distributed but absent from most of Scotland, the only records being for Ayr and Kirkcudbright (Brown 1946) although typical habitats in north Scotland have been examined.

This species is found on rivers but has also been recorded on lake shores (Halbert 1935, Butler 1923). Its presence on Windermere is well known and Macan (1956) pointed out Butler's error in stating that it lived where the current was swift. It obviously prefers sheltered places on the lake, and is restricted almost entirely to stone-built boathouses, being absent from wooden boathouses built on piles which provide no shelter from wave action. It is also absent from smooth-walled boathouses built of concrete or similar materials as opposed to the local-stone type, and this is thought to be due to the fact that these insects overwinter in the crevices of the walls of the latter. Marking experiments have proved that autumn individuals reappear in the same boathouse in the spring, and they are often seen to retire into the boathouse in unfavourable climatic conditions. On river habitats the insects maintain position by constantly rowing against the stream, adults somewhat upstream of nymphs in summer.

Gerris paludum (Fab.)

This large active insect has only been recorded from the south-east of England, a few doubtful records outside this area being shown on the map by means of stippling. Of these records, that for Denbigh occurs in Massee (1955), that for Durham in Butler (1923) and that for Cardiff in Saunders (1892), and in each case there are no details of numbers, dates, or habitat. Halbert (1935) deleted the species from the Irish list. Scudder (1956) quotes a reference to this species in Carpenter (1927) from Cardiganshire, but although *paludum* is referred to in the text, the fauna list quotes *G. gibbifer* in its place. The habitat involved (moor and peat pools and streams) is that of *gibbifer* which I have found commonly in this part of Wales, and so the record is considered to be an error. The presence of this species as far north as Finland on the continent makes it difficult to see why it is so restricted here unless the winters are too damp.

This species occurs on large, open bodies of water, often far from the shore. At Fourwents Pond it inhabited the open water beside the dam and was only seen to shelter beneath the bushes growing on the dam, never by the shore. Massee (1954) recorded it from both still and running water in Kent.

Gerris lateralis Schum.

All previous records of this species are listed as *G. asper* Fieb., but Wagner and Zimmerman (1955) have separated *lateralis* and *asper*, the former being boreo-alpine in distribution. This would account for its greater abundance in northern parts of Britain, most southern records being of one or two individuals, although the species is only locally abundant.

Single specimens have been obtained in many localities, but these are almost always macropterous, and give no true indication of the habitat. Wagner and Zimmerman (1955) stated that it preferred colder situations on the southern edge of its range, and it is often found in peaty uplands in this country (Scudder 1956a). I have taken it with *G. costai* on Dufton Fell, Westmorland, and other Lake District tarns, but the largest known population in the area is at Congo Carr, Windermere. I failed to find it in a series of similar carrs in the area. Brown (1946) described the habitat as thick emergent vegetation.

Gerris costai (H.-S.)

This is a highland species, common in upland areas of Britain, becoming scarcer towards the southern limits of distribution (in North Wales and the southern Pennines). Popham (1951) recorded the species breeding on Wimbledon Common, Surrey, and Butler (1923) quoted a locality in Essex (north), but in view of the known habitat and distribution these records require confirmation. The species is rare in the Lake District. I saw it on Red Screes and Dufton Fell, Westmorland, but it was much commoner in Scottish localities. The species is largely confined to peat pools and stream margins, but has been recorded from brackish water by Poisson (1924) and Walton (1942), possibly in error for *G. thoracicus*.

Gerris thoracicus Schum.

A widely distributed species with the exception of some inland counties of England and Wales and many Scottish and Irish counties where little collecting has been done.

Lindberg (1948 *et al.*) stressed the coastal distribution of this species in Fenno-scandia, indicating its tolerance of brackish water (occurring up to 26% sea water). Among many records of the species from brackish water is one by Naylor and Slinn (1958) for the Isle of Man. It is also recorded from ponds fouled by cattle (Brown 1948, Macan and Macfadyan 1941) and pools on sphagnum (Scudder 1956a), present observations indicating that it is predominantly a brackish-water species occurring in small numbers inland, often in spring and autumn during flight periods. The species was often taken in brackish pools and dykes and farm ponds by the shore. A breeding population was observed on pools on a rocky sea-shore at Towyn, Caerns., just above the lichen zone. Inland records were as follows: March 1, April 4, May 11 (seen in flight), June 2, September 2, all other months 0. These records support the view that the post-overwintering flight in May constitutes the distributive phase.

Gerris gibbifer Schum.

Although widely distributed in England and Wales, the species is absent from most of Scotland and there are no Irish records.

It inhabits pools, dykes and drainage channels on peat from sea-level (Haverthwaite, Lancs. N.) to about 2,000 feet in Wales and the Lake District, being replaced by *G. costai* in higher or more northern localities. Walton (1943) recorded populations on concrete lily-ponds in gardens, and I observed

such a situation at Highgate, London, where the area of the pond was approximately 21 square feet and supported a maximum number of 20 individuals.

Gerris lacustris (Linn.)

This species is pan-British, but has not so far been recorded for many inland Scottish and Irish counties, presumably owing to the lack of collections from these areas. It is common on pools, ponds and lakes, but occurs on more marginal habitats with all other *Gerris* species, being commonly found in mixed populations. It was the commonest species on man-made tarns in the Lake District, and flooded gravel pits at Loughton, Essex, which were surrounded by trees and overhanging bushes, beneath which the insects were common. It occurred in a similar situation at Fourwents Pond, and was frequently collected on ornamental ponds in town gardens and parks. Very large numbers were present on a small pond completely surrounded by paving stones at Rochester (Kent E.). Although surface tension does not appear to be critical (Brinkhurst 1959b), far greater tolerance to other ecological factors seems to be indicated.

Gerris odontogaster (Zett.)

Despite the rarity of Scottish and Welsh records this species is probably present throughout the British Isles. It is an inhabitant of ponds, pools, lakes and canals, living close to the shore, but it is very difficult to distinguish between the habitats of this and *G. lacustris*. These two species frequently occur in mixed populations. Only two pure *odontogaster* populations have been observed, one at Fourwents Pond, Holmwood, Surrey, and the other at Moss Eccles Tarn, Lancs. N. At the former *G. odontogaster* was distributed all round the shores of the pond, and the only *G. lacustris* found were limited to a small area beneath a large oak tree. Moss Eccles Tarn has a peaty, sphagnum shore with Juncus and Potamogeton as Fourwents Pond. In addition to a pure population of *odontogaster* some *Mesovelia furcata* were observed, all previous records of which being in the south-east (Table 1).

There seems little in the physical make-up of the habitats to enable any differentiation between the species, although interspecific competition is probably avoided in mixed populations.

Gerris argentatus Schum.

This is a lowland species in Britain, with some Irish records but none from the Welsh and Scottish highlands. The gap in the English records concerns chiefly the inland industrial counties where lake fringes of clean water are presumably scarce. The animal is the smallest British *Gerris*, however, and its habitat makes it easily overlooked. Butler (1923) recorded *argentatus* frequently with *G. paludum*, which inhabits large ponds and lakes, but with many other authors he showed that it preferred the thick reed fringes of such water-bodies. Some authorities mention brackish water habitats.

In the Lake District I collected the species on Esthwaite, Windermere (Pull Wyke and Mitchell Wyke), Priest Pot, Rydal Water, Blelham Tarn and Loughrigg Tarn, all of which have thick fringes of *Phragmites*. It was mostly

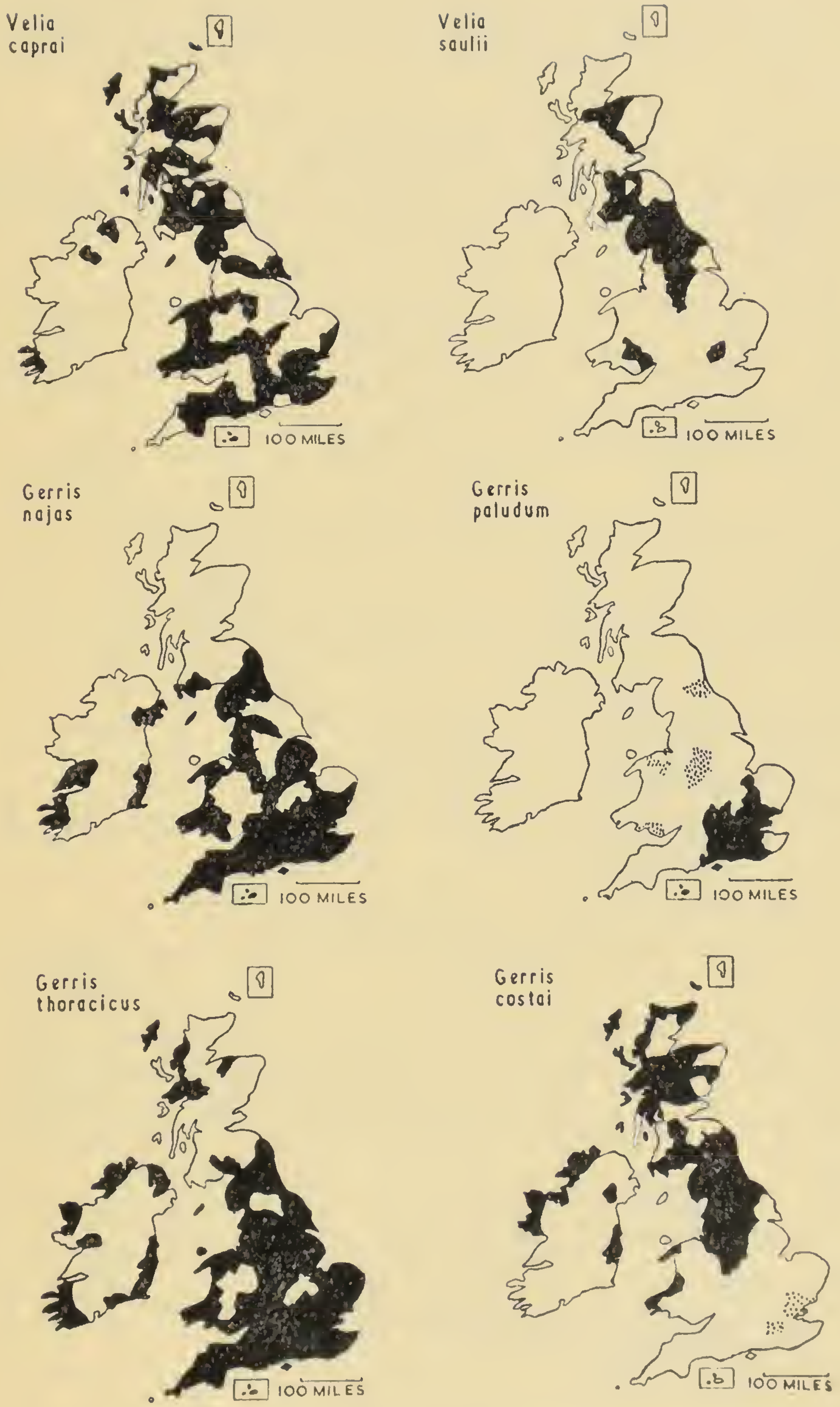


Fig. 1. Vice-county distributions of species of *Vetra* and *Gerris*.

absent from tarns with *Carex* fringes. Other collections were made at Flatford Mill-pool, Dedham Mill-pool and brackish water dykes nearby, Fourwents Pond and an ornamental lake at Osterley, Middlesex. The only factor that all these habitats have in common is a thick fringe of *Phragmites communis*, but the nature of any possible association between this and *G. argentatus* is unknown.

Acknowledgments

This work was carried out whilst the author held a Nature Conservancy studentship. I am indebted to Dr. D. R. Arthur who supervised the work, and to my colleagues Dr. T. T. Macan, Dr. H. B. N. Hynes, Messrs. E. S. Brown, K. Harrison and J. Flint for various records.

Table 1. New County and Vice-County Records and deletions

G. najas

Isle of Man: 1 fifth instar nymph, R. Nebb, 25.vii.49 (H. B. N. Hynes, coll.).

G. paludum

Delete: Cardiganshire (Carpenter, 1927). Error in text for *G. gibbifer*.

G. lateralis

Cheshire: 1 male apter on a pool by Raby Golf Course, 29.ix.57.

G. thoracicus

Isle of Man: 1 fifth instar nymph, Silverburn, 21.vii.49 (H. B. N. Hynes, coll.). Also brackish pools, Spanish Head (Naylor and Slinn, 1958).

G. costai

Caithness: Forss N., Cnoeglass, 21.vii.39 (H. B. N. Hynes, coll.).

Banff: nymphs, peat pools, Tomintoul, 10.viii.57.

Lanark: fifth instar nymphs, stream, Beattock summit, 11.viii.57.

Roxburgh: 1 fifth instar nymph on a lake with *G. odontogaster* (peaty water), near Roberton, 11.viii.57.

G. gibbifer

Radnor: 2 males, pools by River Wye, Rhayader, 7.iv.57.

Brecon: 11 males, 6 females, peat pools by River Irfon, Abergwesyn, 11.iv.57.

G. lacustris

Perth North: males and females, tarn at Faskally House, Pitlochry, 7.viii.57.

Radnor: 1 male, 1 female macropter, 1 female brachypter, Llyn Glyn; 1 male, 1 female macropter, 1 female brachypter, pool by River Wye, Rhayader, 7.iv.57.

Flint: males and females, pool by River Alyn, Mold, 4.vii.49 (H. B. N. Hynes, coll.).

G. odontogaster

Isle of Man: 1 female on a pool, Moor, 10.iv.49 (H. B. N. Hynes).

Aberdeen South: adults and nymphs numerous on a small pool at Braemar, 10.viii.57.

Roxburgh: 1 male, 2 females on a large acid tarn three miles west of Roberton (the flora consisting chiefly of *Phragmites* and *Juncus*), 11.viii.57.

G. argentatus

Westmorland: 1 female, Rydal Water, 6.vii.56.

V. caprai

1. Derby: 1 male, River Wye, running free on the water, Chee Dale, 28.vii.57.
2. Northumberland: numerous adults, stream near Bellingham, 13.viii.57.
3. Roxburgh: adults and nymphs common on peaty stream with mud banks, three miles west of Roberton, 11.viii.57.

Fig. 2. Vice-county records of *Gerris* species.

4. Sutherland W.: adults, inflow of Loch and Ageil, vii.57 (H. B. N. Hynes, coll.).
5. Banff: adults and nymphs on a stream near Tomintoul, 10.viii.57.
6. Selkirk: 1 male on a stream near Birkhill, 10.viii.57.

In all cases only apterous individuals were taken.

V. saulii

1. Derby: 1 male, many nymphs, River Wye, Miller's Dale, 28.vii.57.
2. Brecknock: 3 males, 3 females, River Usk, Brecon, 14.iv.57.
3. Monmouth: 2 males, 1 female, River Honddu, Llanthonybridge, 22.viii.57 (K. Harrison coll.).
4. Northumberland S.: males and females numerous, High Mill stream, Consett, 23.vii.57 (H. B. N. Hynes coll.).
5. Perth N.: 1 male, 1 fifth instar nymph, River Barry, Blair Atholl, 13.viii.57.

*6. Dumfries: 1 female, River Annan, Moffat, 10.viii.57.

*7. Lancashire N. and Westmorland: 1 male, Windermere, on the lake shore, 21.iv.57.

*8. Cumberland: 1 female and nymphs, Bassenthwaite, on the lake shore, 15.v.57; 2 males, Bassenthwaite outflow, 17.v.57; 5 males, 4 females and nymphs, Derwentwater, on the lake shore, 15.v.57.

* New loci. The present distribution records are shown in fig. 1.

Mesovelia furcata

Lancashire N. and Westmorland: males and females common, Moss Eccles Tarn, 3.viii.57.

References

Brinkhurst, R. O., 1957. *Entomologist*, **90**: 260-8.
——— 1959a. *J. Anim. Ecol.* (in press).
——— 1959b. *Proc. zool. Soc. Lond.* (in press).
Brown, E. S., 1946. *Trans. Dumfr. Gall. nat. Hist. Soc.*, **23**: 156-63.
——— 1948. *Trans. Soc. Brit. Ent.*, **9**: 151-95.
——— 1954. *Entomologist*, **87**: 45-53.
Butler, E. A., 1923. *A Biology of the British Hemiptera Heteroptera.* London.
Carpenter, K. E., 1927. *J. Ecol.*, **15**: 33-54.
Flint, J. H., 1956. *Ent. mon. Mag.*, **92**: 228.
Halbert, J. N., 1935. *Proc. R. Irish Acad.*, **42**: 211-318.
Lindberg, H., 1948. *Comment. biol. Helsingf.*, **10**: 1-206.
Macan, T. T., 1956. *Sci. Publ. Freshwat. biol. Ass.*, **16**: 1-74.
Macan, T. T. and MacFadyen, A., 1941. *J. Anim. Ecol.*, **10**: 175-83.
Massee, A. M., 1954. *Trans. Soc. Brit. Ent.*, **11**: 245-80.
——— 1955. *Ent. mon. Mag.*, **91**: 7-27.
Naylor, E., and Slinn, D. J., 1958. *J. Anim. Ecol.*, **27**: 15-26.
Popham, E. J., 1945. *Entomologist*, **78**: 145-8.
——— 1949. *Trans. Soc. Brit. Ent.*, **10**: 1-44.
——— 1951. *J. Soc. Brit. Ent.*, **3**: 158-73.
Poisson, R., 1924. *Bull. biol. Fr. et Belge*, **58**: 49-305.
Saunders, E., 1892. *Hemiptera Heteroptera.* London.
Scudder, G. G. E., 1956. *Ent. mon. Mag.*, **92**: 54-64.
———, 1956a. *Ibid.*, **92**: 221-5.
Wagner, E., and Zimmerman, G. A., 1955. *Zool. Anz.*, **155**: 177-90.
Walton, G. A., 1942. *Trans. R. ent. Soc. Lond.*, **92**: 417-52.
——— 1943. *Trans. Soc. Brit. Ent.*, **8**: 231-90.

THE AUTECOLOGY OF *EUSTROMA RETICULATA* SCHIFF. (LEPIDOPTERA: GEOMETRIDAE) IN THE LAKE DISTRICT WITH NOTES ON ITS PROTECTION

By J. HEATH
(The Nature Conservancy, Merlewood Research Station, Grange-over-Sands, Lancashire)

Introduction

Eustroma reticulata was first recorded from Britain in 1856 when adults were found in the Lake District by T. H. Allis. Although looked for annually, it was not seen again until 1869 when a single specimen was taken. Both ova and larvae were found by J. B. Hodgkinson in 1876 on *Impatiens noli-tangere* near the shore of Windermere. During the period 1877 to 1892 the species was found in a number of additional localities but from 1892 to 1898 its numbers decreased until it appeared to be absent, its decline being attributed to parasitization. In 1904 it was noted from yet another station, where it was plentiful until about 1914, when it declined rapidly until it had apparently disappeared by 1923. Drastic changes in land use which occurred at this locality between 1916 and 1923 doubtless accelerated its decline. Nothing more was heard of this species until it was found plentifully in 1945 although it had been carefully searched for in 1940.

Therefore periods of population decline have been observed during the periods 1892 to 1898 and 1914 to 1923 and a period of increase between 1940 and 1945. Its distribution, according to the published records, was apparently restricted to the central Lake District from Keswick to just south of Bowness (1, 2).

A possible explanation of the population fluctuations and distribution is given below.

Biology

The life history of this species is dealt with in detail by Littlewood (5, 6) and Buckler (3) and may be summarized as follows.

The eggs are attached to the underside of the leaves randomly, there being rarely more than one egg per leaf. The first instar larvae are an almost transparent white; subsequent instars are pale green, the exact colour being somewhat dependent on whether leaves, flowers or seeds are being eaten.

The normal food appears to be either the ovaries of the flowers or the germ cells of the seeds. Leaves are only eaten in an emergency and when this occurs they are perforated by the larvae and not eaten marginally in the normal Lepidopterous manner.

The larval stage lasts for approximately one month. The fully fed larvae spin tough cocoons in which to pupate amongst the plant litter on the surface of the ground. The pupal stage lasts some ten months and it is in this stage, as will be shown, that the greatest mortality occurs. In a normal season pupation is complete by early October.

This insect is confined entirely to *Impatiens noli-tangere*, the only species of *Impatiens* native to this country, but three other species of this genus have been introduced to Britain and the possibility of *Eustroma reticulata* feeding on them needs consideration. The three species concerned are *Impatiens grandiflora*, *Impatiens parviflora*, and *I. biflora*. Of these only *I. parviflora* occurs at present within the area in which *E. reticulata* also occurs. At one station on the west shore of Windermere both *I. noli-tangere* and *I. parviflora* grow together in profusion but although many larvae were found on *I. noli-tangere*, not one was found on *I. parviflora*. Both *I. parviflora* and *I. grandiflora* are more shrubby plants than *I. noli-tangere* and it seems unlikely that they would be suitable host plants for *E. reticulata*.

I. biflora which is at present confined to southern England is, however, very similar indeed to *I. noli-tangere*. *Xanthorhoe biriviata* Borkh. (Lepidoptera: Geometridae) has become established on it (7, 8), although its normal food plant in Scandinavia is *I. noli-tangere* (4). This suggests that *E. reticulata* might become established on *I. biflora* if and when it spreads to the Lake District.

Adults may be found from early July to mid-August and newly emerged specimens may be found at any time during this period. This long emergence period accounts in part for the few individuals seen on any one date.

The adult insect is a rapid, erratic flier. It is usually seen at, or just before, dusk flying at a height of some six to ten feet above ground, and is by no means easy to capture. It does not appear to be readily attracted by light.

Distribution and Abundance

The distribution of the larvae was studied because it is in this stage that the insect is most readily found. The larvae feed solely at night and during daytime rest along the midrib on the underside of a leaf where they resemble, to a remarkable degree, seed pods.

Impatiens noli-tangere occurs in the Lake District at altitudes below about 500 feet in very wet shaded flushes on the Bannisdale and Skiddaw slates. An analysis of the various habitats where *E. reticulata* occurred shows that they fall into four main categories, viz.:

A. Hedgerow.

B. Coppice.

C. High forest without shrub layer.

D. High forest with shrub layer.

At a number of stations two or more of these habitats were present contiguously.

An estimate of the larval populations in each category of habitat was estimated by recording the number of larvae that could be found in one hour. The results of these larval counts are given in Table 1.

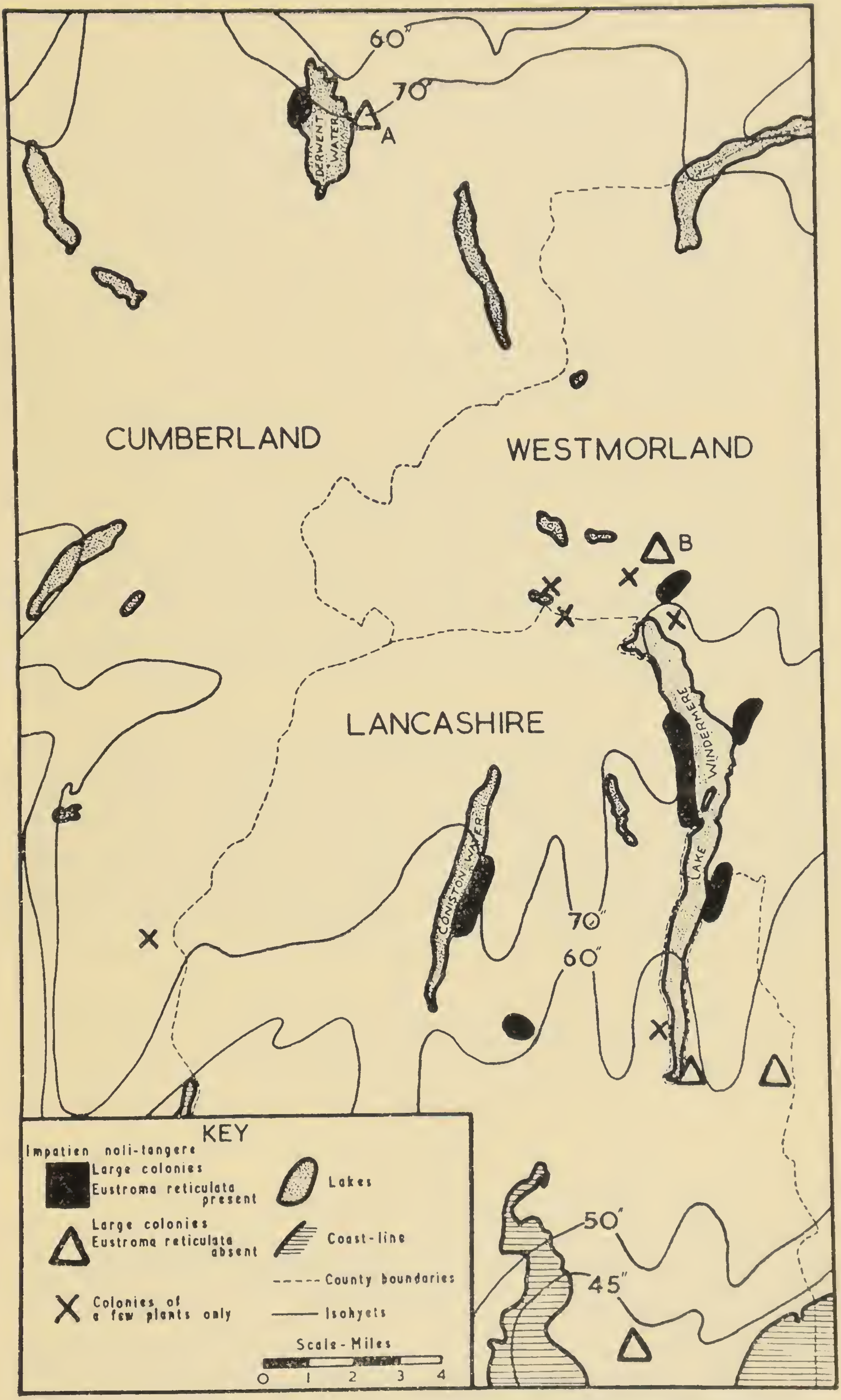


Fig. 1. Distribution of *Impatiens noli-tangere* and *Eustroma reticulata* in the Lake District.

Table 1

Habitat	Mean number of larvae counted per hour	Standard error
A. Hedgerow	9	5
B. Coppice	65	11
C. High forest without shrub	18	13
D. High forest with shrub	67	23

The population means were compared, using Students' **t** test. The population means of habitats B and C were significantly different at the 5% level but the differences between other pairs were not significant.

Observations in the field showed that habitats in category B were very much wetter and less subject to drying out than those in category C. From the population figures given in Table 1 it can be seen that the drier sites (category C) had a significantly lower population of *E. reticulata* than the wet sites (category B). This may be due to various factors but could be due to differences in oviposition or to greater mortality in the immature stages in the drier habitat.

As the pupal stage lasts some ten months and as the pupa is located amongst the litter which normally would be on a very wet flush, it seemed probable that the mortality factor involved was pupal desiccation. To test this an experiment was set up with pupae stored under what are here termed "Dry" and "Damp" conditions. The "Dry" pupae were kept in a well-ventilated cage which has proved satisfactory for most Lepidopterous pupae and the "Damp" pupae were kept undisturbed in very small airtight tins. The results of this experiment are given in Table 2.

Table 2

Conditions	Number of pupae	% Emergence
Dry	47	8.5
Damp	55	51.0

The value of χ^2 for comparison of the emergence in the two sets of conditions is 140 (1 d.f. $P<0.001$) which suggests that emergence is inhibited by dry conditions.

From the foregoing field observations and the laboratory experiment it seemed that very wet habitat conditions were essential for *Eustroma reticulata* to maintain itself and that its distribution would be related to rainfall.

To test this assumption a survey of all the known stations for *Impatiens noli-tangere* was carried out. As will be seen from the map the moth only occurs along the shores of Windermere, Coniston Water, Derwent Water and in the Rusland Valley at those localities where the mean annual rainfall exceeds 60 inches per annum. It is absent from a few small colonies of the plant which consisted of only one or two individuals within this area and from two large colonies marked A and B on the map (fig. 1). Colony A is, as far as could be observed, identical with many others where the insect does occur. Its absence is based on a single visit and as it has been previously recorded—in 1894—it may well still exist there. Colony B is unique in that in contrast to the normal wet flush habitat for *Impatiens noli-tangere* it is relatively well drained with grasses forming the dominant component of the ground flora. Also the tree cover in this habitat is only slight.

Seasonal Incidence

As has been shown from previously published records, this insect has shown great population fluctuations. It declined rapidly during the periods 1895 to 1898, 1914 to 1916, and increased during the period 1940 to 1945. It has been shown above that the abundance of this species is probably dependent upon adequate moisture conditions in its habitat and therefore these population variations may have been caused by abnormal variations in rainfall.

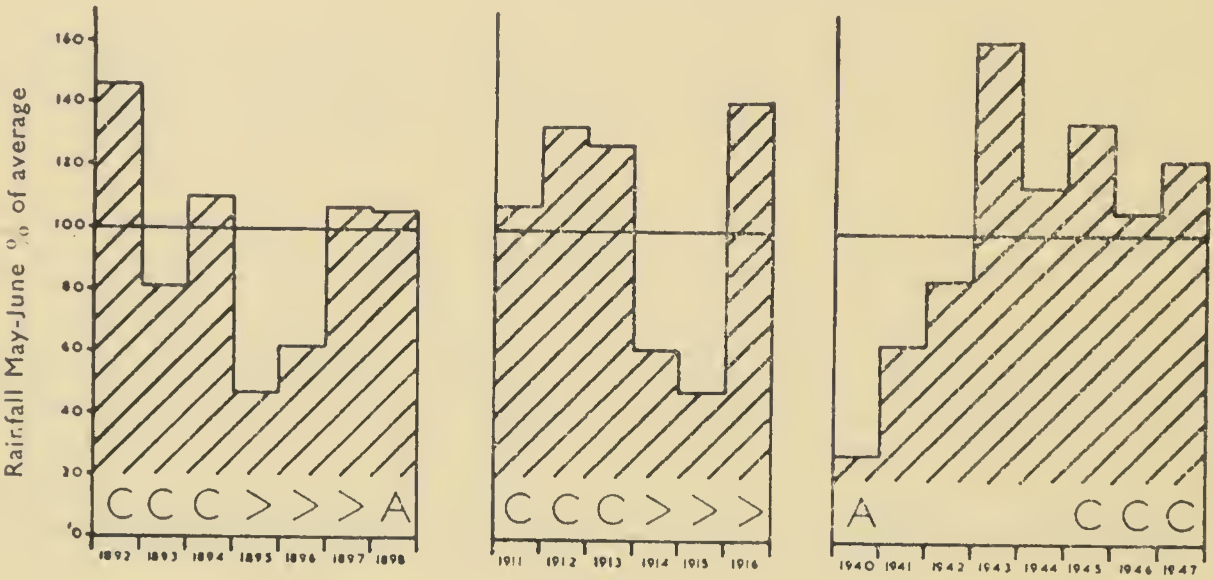
The monthly rainfall totals for the relevant periods were examined and it was found that the declines in population were preceded by two successive years of drought in May and June. Conversely, successive years of above normal rainfall in these months led to the observed population build up (fig. 2). The period May and June was examined as it had been noted during the laboratory experiment on pupal desiccation that mortality occurred mainly during the last 8-10 weeks of the 10-month pupal stage, i.e. May and June. This was readily noticeable as healthy pupae are bright emerald green whereas dead pupae are dark brown.

It should be noted that no published records of any parasites of *E. reticulata* have been traced nor were any parasites bred from the specimens reared during the course of these studies and therefore the explanation of the decline during the period from 1892 to 1898 being due to parasitization seems to be conjectural.

Discussion

Eustroma reticulata is an insect which, as it is confined to one host plant, can only maintain itself if this plant is allowed to remain undisturbed. Also as has been shown, although the plant can exist under a variety of minor habitat variations, e.g. different rainfall levels, different cover levels, the insect has only been found in conditions of high rainfall and dense cover. *E. reticulata* has been listed by the Committee for the Protection of British Insects of the Royal Entomological Society of London as being in need of protection (9). If it is to survive it is essential that its habitats should be left undisturbed. Its major enemy is not the collector but the forester, builder

or landscape gardener. *Impatiens noli-tangere* was at one time common along many streams on the shores of Windermere and Rydal Water but today many of these streams flow through well-mown lawns and formal rock-gardens. Many of its existing habitats will sooner or later be grossly disturbed by forestry operations when the existing tree crops reach maturity. Whilst at present it is in no immediate danger, unless present management conditions are modified the species is likely to become extinct. The author would like to record here the co-operation and interest shown by the Lakes U.D.C.



A = Absent; C = Common; > Decreasing

Fig. 2. Effect of rainfall on seasonal incidence of *Eustroma reticulata*.

which owns one of the habitats (a public park) and whose Parks Committee was even prepared to modify their normal horticultural practices and to erect fences should these measures have been necessary for the preservation of the host plant and the environmental conditions. Also, one private land-owner changed his garden plans at the author's suggestion so that a small colony of *E. reticulata* could be protected. Conservation measures in this instance are relatively simple, the main essentials being:

1. Preservation of a dense cover.
2. Maintenance of flush conditions.
3. Restriction of cultural operations to the period November to April to obviate disturbance of *I. noli-tangere*.

Summary

The history, biology, food requirements and habits of *Eustroma reticulata* are outlined. Its distribution, both local and regional, is discussed and evidence is presented to show a correlation with rainfall and habitat conditions. Evidence of a relationship between population fluctuations and rainfall variations during the last months of the ten-month pupal stage is presented. The possibility of *E. reticulata* transferring from the native *Impatiens* to introduced species is discussed. Measures for the protection of this extremely local insect are suggested.

Acknowledgments

In addition to the numerous residents of the Lake District who have generously given permission to work on their property, acknowledgment is due to Dr. D. E. Coombe and Dr. D. Ratcliffe for supplying details of the distribution of *Impatiens noli-tangere* and to Dr. E. M. Hering for details of the European distribution of *Eustroma reticulata* and suggested lines of investigation.

References

1. Barrett, C. G., 1893-1907. *The Lepidoptera of the British Isles*, **8**: 247. London.
2. Birkett, Dr. Neville L., 1951. *Trans. Raven. Ent. and Nat. Hist. Soc.*, **1951**: 37-9.
3. Buckler, W., 1877-99. *The Larvae of British Butterflies and Moths*, **8**: 89. Ray. Soc. London.
4. Klocker, A., 1915. *Dansk Sommerfugle*, **4**: 62. *Danmarks Fauna*, Copenhagen.
5. Littlewood, F., 1912a. *Entomologist*, **65**: 85.
6. ——— 1912b. *Entomologist*, **65**: 97-8.
7. Minnion, W. E., and Goodban, B. S., 1956. *Ent. Gaz.*, **7**: 3-6.
8. Minnion, W. E., 1957. *Ent. Gaz.*, **8**: 190-1.
9. Riley, N. D., 1951. *Entomologist*, **84**: 97-8.

CORRIGENDUM

We apologise to the authors concerned for the following misprints which appeared in Volume 6, Part 1, of the *Journal.*

HANNEY, P. W.: Page 5: for "Corxids" read "Corixids."

JACKSON, D. J.: Page 15, line 4: for "Largeward" read "Largoward."
Page 15, line 16: for "the mand" read "them and."
Page 17, line 4: for "trunks" read "trunk."
Page 18, line 20: for "*Nassonia*" read "*Mormoniella* (*Nasonia*)."
Page 19, title: for "pupa" read "prepupa."
Page 20, line 6: for "*Nassonia*" read "*Nasonia.*"

Additions to the County Records of Spiders with notes on two species of interest

By G. P. Lampel

1. *Micaria silesiaca* L. Koch male new to Britain.

Both sexes of this species were taken in fair numbers running in the sun amongst ants on a bare earth mound on Upper Hollesley Common, Suffolk, between 1st and 23rd June, 1955. None were to be found on this mound at other times of the year, and the only immature taken was a subadult male in nearby heather in September, which suggests that they emerge on to bare open spaces only to mate. The British records of this species comprise two females from Hampshire (Locket and Millidge 1953).

2. *Tegenaria pagana* (C. L. Koch) established in the vicinity of banana warehouses.

A female *Tegenaria* taken from its web on a house wall in Ipswich, Suffolk, fairly near a banana store on 20.x.54 proved to be this species, so far recorded in the British Isles only from Castleknock, near Dublin (Pack-Beresford 1920). A search was therefore made for this species in and near a banana house in Oxford Market. *T. pagana* was found established throughout the Market building, almost entirely displacing *T. domestica* (Clk) in the corridors and cold and hot rooms of the store itself, and one was found on the wall of a nearby building. Both sexes were taken, females throughout the year 1955/56. It seems probable that it will be found in similar situations in other towns. The Directory of Dublin, however, shows no fruit store near the original locality. The species is known from the Canary Islands, a principal source of bananas.

Simon (1875 and 1937) describes a subspecies *T. pagana urbana*, distinguished from the type by its larger size, darker colour and eye pattern. Both extremes were found in Oxford, but there also appeared to be intermediates between the two forms. Locket and Millidge (1953) state that the sternum pattern is not a reliable character in this species, but in this series the shape and orientation of the hind pair of spots, as figured in M. Dahl (1931) is fairly constant if the pattern is visible at all, even in young specimens.

3. New County Records.

These records are believed to be new for the counties stated. The following abbreviations are used: B. for near Beckhampton, Wilts.; S.F. for grassy clearing in Savernake Forest, Wilts.; W.W. for West Wood, Wilts.; W.M. for Weston-super-Mare, Somerset, on 7.vii.54; U.H.C. for bare earth mound and nearby heather, Upper Hollesley Common, Suffolk; R.F. for Redgrave Fen, Suffolk; L.F. for Little Fen, Norfolk (these two fens are confluent); B.s.c. for Both sexes common. Where no locality is given for a species, it has been found in many places in the county.

Wiltshire. All records for 1954. *Lathys humilis* Bl., B.s.c. Cherhill May-July. *Drassodes lapidosus* var. *macer* (Thor.), ♂♂ in short grass on the downs with very small light ♀♀ B. May. *D. lapidosus* var. *cupreus* (Bl.), ♂♂ B. May-July. *D. pubescens* (Thor.), B.s.c. S.F. May-June. *Clubiona coerulescens* L.K., many subadults of both sexes beaten from low oak W.W. in late August, moulting in captivity in early Sept. *C. diversa* O.P.-C., B.s.c. S.F., W.W. and B. May-August. *Agroeca brunnea* (Bl.), ♀♀♂ in grass W.W. 29.viii.54. *A. proxima* (O.P.-C.), B.s.c. in grass W.W. August. *Xysticus bifasciatus* C.L.K., ♀ in grass S.F. 9.v.54, ♀ under stone 11.vii.54. *Oxyptila trux* (Bl.), B.s.c. May-June. *Philodromus aureolus caespiticolis* Walck., B.s.c. June-July. *Neon reticulatus* (Bl.), ♂♂ S.F. 26.vi.54. *Lycosa tarsalis* Thor., B.s.c. June-July. *L. lugubris* (Walck.), B.s.c. May-August. *Pirata uliginosus* (Thor.), B.s.c. in damp grass in dry dew-pond with *P. hygrophilus* Thor. S.F. May-June, and ♀♀ in grass W.W. August. *Trochosa spinipalpis* (F.O.P.-C.), ♀♀ in short burrows with egg-sacs in turf S.F. 30.v.54, among stones W.W. 21.vii.54, and wandering in grass Wroughton 3.iv.54. *Textrix denticulata* (Oliv.), ♀♀ common under loose bark on dead trees S.F. June-July. *Ero cambridgei* Kulcz., B.s.c. July-August. *Asagena phalerata* (Panz.). ♀♂♂ among stones and heather W.W. July. *Enoplognatha thoracica* (Hahn), B.s.c. May-August. *Tetragnatha obtusa* C.L.K., B.s.c. on trees on the downs B. June-August. *Araneus sturmi* (Hahn), ♀ on pine B. 14.viii.54. *Cercidia prominens* (Westr.), ♀♀♂ S.F. May-June. *Ceratinella brevipes* (Westr.), ♀ in grass Cherhill 28.iv.54. *Walckenaera acuminata* Bl., ♀♀ in grass B. May-June. *Cornicularia cuspidata* (Bl.), ♀ B. 1.v.54. *Entelecara acuminata* (Wid.), ♀♀ beaten from trees W.W. July-August. *Dismodicus bifrons* (Bl.), B.s.c. April-July. *Peponocranium ludicrum* (O.P.-C.), ♀♀ B. May. *Oedothorax retusus* (Westr.), ♀ B. 10.iv.54. *Trichopterna thorelli* (Westr.), ♀ B. 25.v.54. *Lophocarenum parallelum* (Wid.), ♀♀ S.F. and B. May-June. *Monocephalus fuscipes* (Bl.), ♀♀ B. May. *Savignia frontata* (Bl.), ♂♂ B. 11.iv.54. *Leptorhoptrum robustum* (Westr.), ♀♀ in damp grass B. April-May. *Porrhomma microphthalmum* (O.P.-C.), ♀ under stone B. 1.v.54. *Centromerita bicolor* (Bl.), ♀ B. 14.iv.54. *Oreonetides abnormis* (Bl.), ♀ B. 22.vi.54, ♂ W.W. 4.viii.54. *Poeciloneta globosa* (Wid.), ♀♀ B. April-May. *Bolyphantes luteolus* (Bl.), ♀ in grass B. 14.iv.54. *Lepthyphantes ericaeus* (Bl.), ♀ B. 1.v.54. *Linyphia furtiva* O.P.-C., ♀ in grass S.F. 30.v.54.

Suffolk. All dates 1955 unless otherwise stated. *Drassodes lapidosus* var. *cupreus* (Bl.), ♂♂ common at all seasons. *Zelotes pedestris* (C.L.K.), ♀♀ under wood chips U.H.C. June. *Z. pusillus* (C.L.K.), ♀♂♂ U.H.C. April-May. *Z. petrensis* (C.L.K.), ♀♀ in silk cells under wood chips on earth U.H.C. 1.v.55 and 1-5.vi.55, ♂ in heather U.H.C. 4.ix.55. *Micaria silesiaca* L.K., see above. *Clubiona coerulescens* L.K., both sexes not uncommon in small oaks and undergrowth at edge of Bonny Wood 6-19.ix.54. *C. trivialis* C.L.K., B.s.c. U.H.C. July-Sept. *C. neglecta* O.P.-C., ♀♀ in silk cells in short grass 7.viii.55, and ♂ in reed debris 5.vi.55, Oxley Marsh. *Agroeca proxima* (O.P.-C.), B.s.c. U.H.C. June-Sept. *A. inopina* O.P.-C., ♀ U.H.C. 4.ix.55. *Scotina gracilipes* (Bl.), ♀♀♂ in heather U.H.C. Sept. *Phrurolithus festivus* (C.L.K.), ♀ U.H.C. 7.v.55. *Xysticus kochi* Thor., ♂ U.H.C. 4.i.56. *X. sabulosus* (Hahn), dark ♀♀ frequent on egg-sacs under wood chips on earth U.H.C. April-June, and ♂♂ and much lighter ♀♀ common again in Sept. U.H.C. *Oxyptila simplex* (O.P.-C.), ♂ on reed Oxley Marsh 7.v.55. *Marpissa pomatia* (Walck.), ♀♀ common in reed heads, ♂♂ amongst reeds, R.F. July-Sept. *Myrmarachne formicaria* (Degeer), ♂ in reed detritus R.F. 11.v.55. *Arctosa leopardus* (Sund.), both sexes frequent in marshes June-July. *Tegenaria pagana* C.L.K., see above. *Ero tuberculata* (Degeer), ♀♂ in heather U.H.C. 20.ix.55. *Episinus angulatus* (Bl.), B.s.c. in summer. *Theridion lunatum* (Clk.), ♀ on tree Finningham 6.viii.55. *T. saxatile* C.L.K., ♀♀ in webs along earth banks R.F. 20.vii.55. *Tetragnatha nigrita* Lendl., ♀♀♂ in webs on reeds in ditch R.F. 24.vii.55. *Pachygnatha listeri* Sund., B.s.c. in Bonny Wood August-Nov. 1954. *Araneus adiantus* (Walck.), ♀♀♂ on willow herb and heather U.H.C. 23.vii.55. *Walckenaera acuminata* Bl., ♀♀ Kesgrave 22.ix.55 and R.F. 11.v.55. *Phaulothrix hardyi* (Bl.), ♀ on earth mound U.H.C. 21.ix.55. *Centromerita bicolor* (Bl.), ♀ Ten Wood 9.iv.55. *C. concinna* (Thor.), ♂ U.H.C. 9.x.55. *Drapetisca socialis* (Sund.), B.s.c. in autumn. *Tapinopa longidens* (Wid.), B.s.c. U.H.C. and Oxley Marsh August-Sept. *Floronia bucculenta* (Clk.), B.s.c. Bonny Wood and Ten Wood Sept.-Oct. 1954. *Bolyphantes luteolus* (Bl.), ♀♀♂ U.H.C. 21.ix.55. *Lepthyphantes minutus* (Bl.), ♀ on tree Kesgrave 22.ix.55.

NORFOLK. *Zelotes latreillei* (Sim.), ♂ L.F. 11.v.55. *Oxyptila brevipes* (Hahn), ♀ in moss L.F. 3.ix.55. *Tibellus maritimus* (Menge), ♀♀ L.F. July 1955. *Heliophanus flavipes* C.L.K., B.s.c. L.F. May-July 1955. *Marpissa pomatia* (Walck.), ♀♀ common in reed heads L.F. July-Sept. 1955. *Neon reticulatus* (Bl.), B.s.c. in reed debris L.F. May-Sept. 1955. *Theridion saxatile* C.L.K., ♀♀ frequent along earth banks L.F. 13.vii.55. *T. impressum* L.K., ♀♀ on thistles and trees L.F. July-Sept. 1955. *Enoplognatha thoracica* (Hahn), ♂♂ L.F. 25.v.55. *Tetragnatha nigrita* Lendl., ♀♀ in webs on banks of ditch L.F. 20.vii.55. *Dismodicus bifrons* (Bl.), ♀♀ L.F. 20.vii.55. *Taranucnus setosus* (O.P.-C.), ♀♀♂ in webs in reeds L.F. 11.v.55.

SOMERSET. *Zelotes praeficus* (L.K.), ♀ in grass clump on beach W.M. *Clubiona terrestris* Westr., ♂ Cheddar Gorge 11.viii.54. *C. neglecta* O.P.-C., ♂ under stone on beach W.M. *Phrurolithus festivus* (C.L.K.), ♀♀ W.M. *Lycosa purbeckensis* (F.O.P.-C.), ♀♀ with egg-sacs on mudflats W.M. *Xerolycosa miniata* (C.L.K.), ♂ on dune W.M. *Araneus sclopetarius* Clk., ♀♀ common on bridges and banks of the Avon in Bath 27.vi.54. *Wideria antica* (Wid.), ♀ W.M.

SHROPSHIRE. *Oedothorax gibbosus* (Bl.), ♀ Shrewsbury 15.xi.53. *Centromerita concinna* (Thor.), ♀♀ Whixall Moss 17.iii.56. *Taranucnus setosus* (O.P.-C.), both sexes in reeds Whixall Moss 17.iii.56.

OXFORDSHIRE. *Tegeneria pagana* C.L.K., see above.

YORKSHIRE. *Lycosa prativaga* L.K., ♀ Ilkley Moor 10.ix.53.

Acknowledgments

I am grateful to Dr. A. F. Millidge, Mr. G. H. Locket and Mr. A. A. D. La Touche for help and confirmation of the more difficult species.

References

Dahl, M., 1931. *Die Tierwelt Deutschlands.* Spinnentiere oder Arachnoidea, **VI**:24. Fam. Agelenidae.

Locket, G. H., and Millidge, A. F., 1953. *British Spiders*, Vol. 2. Ray Soc.

Simon, E., 1875. *Les Arachnides de France*, Tome **II**: 1-350.

——— 1937. *Les Arachnides de France*, Tome **VI, 5**: 979-1298.

Pack-Beresford, D. R., 1920. Some new and rare Irish Spiders. *Irish Nat.*, **29**: 29-33.

The Hemiptera-Heteroptera of Kent

(Supplement I)

By A. M. Massee

A complete list of the species of Hemiptera-Heteroptera recorded in Kent was published four years ago (Massee, *Trans. Soc. Brit. Ent.*, 1954, **11**: 245-80).

During the past four years, nineteen species and two varieties have been added to the list, which now totals 435 species and two additional varieties.

Details of these new records are presented in the same manner as in the original publication, namely, distribution; localities; brief notes on habits and host associations; time of occurrence of adults in the field.

The names of the recorders are abbreviated as follows: A. A. Allen (A.A.A.); A. J. Chitty (Ch.); A. M. Massee (M.); T. R. E. Southwood (T.R.E.S.); A. R. Waterson (A.R.W.).

Coreidae

Liorhyssus hyalinus (Fab.). Very rare. Blackheath (A.A.A.). One specimen. 9.

Lygaeidae

Drymus ryeii D. and S. Common. East Malling, Blean, Ham Street, Otford, Boxley (M.); Blackheath (A.A.A.). Hibernates as adult at roots of grass, in dead leaves and other kinds of vegetation. 1-12.

Gastrodes abietum Bergroth. Not common. Otterden (M.). Spruce fir. 8.

Tingitidae

Physatocheila smreczynskii China. Rare. Darenth Wood (M.). *Malus silvestris* (L.) Mill. 5.

Nabidae

Nabis pseudoferus Remane. Local. Deal, Dover, Sandwich Bay (M.); Ham Street (T.R.E.S.) (M.). Sweeping grassy situations. 6, 7, 8.

Anthocoridae

Anthocoris minki Dohrn. Locally common. East Malling (M.). *Fraxinus*. 9.

Anthocoris butleri Le Quesne. Local. Blackheath (A.A.A.). *Buxus*. 8, 9.

Lasiochilus sladeni Distant. Rare. Blackheath (A.A.A.). In pile of dead grass. Possibly introduced. 9.

MIRIDAE

Phytocoris insignis Reuter. Locally common. Ham Street (M.). Sweeping grass growing amongst heather. 8.

Poeciloscytus palustris Reuter. Deal (Ch.). 7.

Stenodema laevigatum (L.) var. *melas* Reuter. Rare. Ham Street (M.). 6.

Dicyphus constrictus (Boheman). Rare. East Peckham (M.). *Melandrium rubrum* (Weig.). 9.

Malacocoris chlorizans (Panz.) var. *smaragdinus* Fieb. Rare. East Peckham (M.). 8.

Orthocephalus coriaceus (F.). Rare. Otterden. *Cerastium*. 7.

Psallus assimilis Stichel. Rare. Blean (M.). *Corylus*. 6.

Psallus perrisi Wagner. Local. Darenth Wood, Tunbridge Wells, Blean, Holly Hill (M.). 6, 7, 8.

Psallus wagneri Ossianilsson. Rare. Ham Street (M.). *Betula*. 6.

Psallus flavellus Stichel. Local. East Malling, Blean, Birling, Holly Hill (M.). *Fraxinus*. 6, 7.

Psallus masseei Woodroffe. Rare. Ham Street (M.). *Quercus*. 7.

Asciodema fieberi (D. and S.). Local. East Malling, West Malling, Yalding (M.). *Ulmus glabra* Huds. 6, 7, 8.

MESOVELIIDAE

Mesovelia furcata Mulant and Rey. Local. Appledore (M.). Associated with *Potamogeton natans* (L.) on the Military Canal. 9.

CORIXIDAE

Corixa striata (L.). Local. Folkestone, Dover (A.R.W.); Broodlands, Appledore, Ivychurch (M.). Military Canal and dykes. 9.

Reviews

Collecting, Preserving and Studying Insects **H. Oldroyd**

London, Hutchinson & Co. Ltd., 1958., 327 *pp.*, 15 *pls.*, 135 *figs.* *Price* 25/-

Publications on this subject are legion and we ourselves have several dozens ranging in date from 1774 (Lettsom, ed. 2) to 1955 (Beirne) and in price from twopence ("Pupa Hunting" by H. Guard Knaggs) to two guineas (Wagstaffe and Fidler). We can unhesitatingly say, however, that Mr. Oldroyd's contribution is the best, partly by virtue of being the most recent, but essentially because he goes further than his predecessors in not restricting himself merely to collecting and preserving. He rightly sees these activities against a broad entomological backcloth and he has much to say of interest and importance on forming and working with insect collections, insect photography, many aspects of studying insects, recording and describing, and other cognate topics.

Written with clarity and commendable accuracy, there are also occasional flashes of dry humour in unexpected places which make for smoother reading. It would be impossible to include in a book of such reasonable size all the techniques or variations current in entomology but Mr. Oldroyd shows no unreasonable bias and has tried to offer as wide a range as possible. Occasionally in doing so he lacks sufficient detail as in the instance of the, to my mind, important vegetable product "laurel." What will the beginner seek in pursuance of Mr. Oldroyd's instruction "the leaves are picked and crushed or chopped"—will he select *Laurus nobilis*, the true Laurel, or *Aucuba japonica*, the popular "laurel," or even rhododendron leaves ? What a disappointment he will get from anything but the cherry-laurel, *Prunus Laurocerasus !*

W.D.H.

Insect Migration **C. B. Williams**

Collins, New Naturalist Series. 235 *pp.*, 24 *pls.*, 30/-

That birds migrate southwards at the approach of autumn and return in early spring is well known, but even today there are many who have never considered the possibility of insects migrating in a similar manner. It is to these readers that Dr. Williams' fascinating book is to be specially recommended. The author will convince his reader of insect migration, not by specious argument, but by a wealth of fact and scientific observation collected, at times under most difficult conditions. Dr. Williams has an interesting story to tell and it is told skilfully. There is the case of the northern migration of a dragonfly, *Libellula quadrimaculata*, carrying a trematode, which causes reduction of egg laying and death of poultry. Swarms of these dragonflies regularly appear on the shores of the Baltic and the local inhabitants immediately pen up their hens as it has been observed that after a diet of these insects the hens cease to lay.

Where insects occur in large numbers migration can easily be observed, but the northern migrations in spring are frequently on a much smaller scale. The evidence for this makes most fascinating reading. The author also

discusses many problems associated with migration and explains how the facts have been collected and the difficulties which have had to be surmounted. Once the reader takes up the book he will find it difficult to put it down until he reaches the final page. E.J.P.

Insect Flight **J. W. S. Pringle**

Cambridge Monographs in Experimental Biology No. 9, *C.U.P.*

132 *pp.*, 52 *figs.*, 15/-

The great advances in aeronautics during and since World War II have stimulated a more intensive study of insect flight. So rapid has been the progress in this field that a review of present knowledge is needed and it is this gap which Dr. Pringle has filled.

Between the covers of this little book is a wealth of scientific fact and observation and though clearly written the English is in places too concise for easy reading. For many years it has been known that insects move their wings at speeds too fast to be explained in terms of normal muscle physiology. Studies of the functional morphology of the insect thorax and of muscle histology have led, respectively, to the discovery of the click mechanism of the thorax and of fibrillar muscles with their unusual properties of developing a myogenic rhythm under tension. These discoveries have gone a long way to the solution of this problem, but Dr. Pringle makes it clear that the last words have not been said. The most interesting sections of the book are the chapters dealing with the aerodynamics of insect flight and the complex sensory and nervous mechanisms which not only enable insects to fly with precision, but also to maintain balance and orientation. It is here that the author brings us to the very frontiers of knowledge.

The book will, therefore, be of interest both to the general reader as a useful summary of a very specialised field and to the specialist in indicating the gaps in existing knowledge. Like so many modern works the book cuts across the traditional divisions of biology and although the author has attempted to co-ordinate the advances from widely different fields, he has shown that the flying insect is a most complex self regulating mechanism which challenges man's skill and ingenuity to unravel its secrets. E.J.P.

Bestimmungstabellen der Blattminen von Europa **E. M. Hering**

Band II, pp. 651-1185. *The Hague, Dr. W. Junk*

Volumes I and III of Professor Hering's monumental work on European leaf-mining insects were reviewed as long ago as November 1957 (*J. Soc. Brit. Ent.* 5:226). The completion of the keys, comprising host-plant genera M to Z and species entries 3,134 to 5,551, is now welcomed. Sufficient time has now elapsed to fully confirm the view of the fundamental and unique qualities of Professor Hering's great contribution to "minology," based on a lifetime of study and experience. Once again we are impressed by the great extent of the biological as well as systematic data which has been compressed in readily accessible form into the analytical tables or keys. W.D.H.

ROBERT WYLIE LLOYD

1868-1958

With the death of Robert Wylie Lloyd on 29th April, 1958, at his home in London, the British Trust for Entomology lost a founder-member, and British Entomology a great and active supporter of good causes. Lloyd was born in Lancashire on 17th March, 1868, and during the course of his long life achieved great financial success. As became a prudent and successful business man, he was careful in the bestowal of his patronage, but many causes, both entomological and non-entomological, benefited from his generosity. The latter have been acknowledged elsewhere but let us here remember his many contributions to the advancement of entomology such as, for instance, the gift of the beautiful panelled meeting room now used by the Royal Entomological Society of London, or the continuance of the valuable *Entomologists' Monthly Magazine* since the beginning of the century.

The writer would like to pay a special tribute to R.W.L. for the help he gave his Department of the Manchester Museum on several occasions, including the opportunity to purchase the fine Spaeth collection of Cassidinae and culminating in the bequest of his entomological collections and library.

Lloyd was a keen coleopterist and in the course of the years had amassed an excellent collection of the British species, incorporating the results of his own field work with the pick of other collections which he purchased from time to time. During his periodic visits to Manchester on business, Lloyd would come to the Museum to "talk beetles" for an hour or so and was always full of enthusiasm for the subject. He continued to collect with great vigour and interest even up to a year or so of his death, and the writer remembers with pleasure a few such trips during the Manchester visits. Lloyd's fine collection of British Coleoptera now forms one of the treasures of his extensive bequests to the Manchester Museum.

So much could be written regarding Lloyd's active life, his great interest in mountaineering and his splendid support of the last, successful Everest Expedition, his wonderful collection of paintings and art treasures, his gifts and bequests, but let it suffice to close this brief notice with the names of three British beetles in which he had a special interest and with which his name will be long associated: *Apion laevigatum* Payk.), *Gynandrophthalma affinis* (Ill.) and *Pyrrhidium sanguineum* (L.). W.D.H.

Eleventh Congress of British Entomologists

Oxford, July 3rd-6th, 1959

By kind permission of Professor G. C. Varley, the Eleventh Congress of British Entomologists to be organised by the Society for British Entomology will be held in Oxford on 3rd to 6th July, 1959. The Congress is organised by Dr. M. W. R. de Graham of the Hope Department of Entomology, University Museum, Oxford, from whom full details may be obtained on application.

Programme

OF THE

ELEVENTH CONGRESS

OF

BRITISH ENTOMOLOGISTS

TO BE HELD AT

OXFORD

3rd to 6th JULY, 1959

Organized by the

SOCIETY FOR BRITISH ENTOMOLOGY

★

"In the study of Entomology, the man of science will find abundant scope for the exercise of his zeal".
George Samouelle, "The Entomologist's useful Compendium," 1824.

★

Hon. Organizing Secretary:

M. W. R. de V. Graham, M.A., D. Phil., F.R.E.S.,

Hope Department, University Museum, Oxford

(*Telephone:* Oxford 57527)

INSTRUCTIONS TO VISITORS

VENUE AND HEADQUARTERS

The Eleventh Congress of British Entomologists will be held in Oxford on 3rd to 6th July, 1959, by kind invitation of Professor G. C. Varley, M.A., PH.D., Hope Professor of Zoology (Entomology) in the University.

The addresses will be given in a lecture hall of the Department of Zoology, University Museum, Parks Road, by kind permission of Professor Sir Alister Hardy, F.R.S., Linacre Professor of Zoology and Comparative Anatomy. The exhibition meeting will be held in a laboratory of the Department.

Accommodation for both ladies and gentlemen will be at Jesus College, Turl Street, Oxford, by kind permission of the Principal and Fellows. The charge of £1 7s. 6d. per day will include accommodation, dinner, breakfast and luncheon (packed luncheon on Sunday, 5th July). There will be a supplementary charge of 5s. od. in respect of the Congress Dinner (Saturday, 4th July). For those wishing to stay the night of Monday, 6th July, the extra charge will be £1 5s. od. for accommodation, dinner and breakfast. Beers and wines will be obtainable to order at the luncheons and dinners.

Telephone numbers: Jesus College (Oxford 3118) and Department of Zoology and Comparative Anatomy (55278).

Parking arrangements. By kind permission of the Delegates of the University Museum, members' cars may be parked in the Museum forecourt.

Jesus College is about three-quarters of a mile from Oxford Railway Station. No. 1 'bus goes from the main road near the station yard to Carfax, which is less than five minutes' walk from Jesus College.

CONGRESS OFFICE

A Congress Office will be set up at Jesus College at 2.30 p.m. on Friday, 3rd July, to look after the needs of members, who are asked to visit it on arrival. It will be re-opened in the Department of Zoology and Comparative Anatomy for two short periods the following day.

INVITATION TO CONGRESS AND FORM OF APPLICATION

A cordial invitation to attend the Congress is extended to all persons of either sex who are interested in any aspect of British Entomology, and to be accompanied by wife or husband. Those who intend coming are requested to complete the Form of Application on page 7, which should be detached and posted to the Hon. Organizing Secretary at the Hope Department of Entomology, University Museum, Oxford, as soon as possible.

The organizing secretary would be pleased to have early notification of intention to attend, especially from married couples and unaccompanied ladies, so that accommodation in Jesus College can be planned.

DAY VISITORS

Day visitors will be welcome to join the Congress and take part in all items on the Congress programme. It is hoped that as many as possible will join the residents at meals and social gatherings. The prices of meals are indicated on the Form of Application on page 7. It will assist the catering arrangements if an early indication of your requirements can be made.

Day visitors are especially urged to register at the Congress Office on Friday, 3rd July, leaving the organizers free the following day to attend to those unable to reach Oxford earlier.

EXCURSIONS

An All-day Excursion by coach has been arranged to the Chiltern Hills on Sunday, 5th July. Tickets for seats on the coach must be obtained beforehand from the Congress Office.

An Afternoon Excursion to Wytham Wood has been arranged for Monday, 6th July. Suitable transport, and afternoon tea, will be arranged as soon as it is known approximately how many members wish to join this excursion.

GUIDED TOUR

Attention is drawn to the sightseeing tour of two of the Oxford colleges which will very kindly be led by Mrs. Gilbert Hopwood.

EXHIBITS

On Saturday, 4th July, after tea, there will be an exhibition meeting, at which exhibits brought by visitors, and selected parts of the collections of the Hope Department of Entomology, will be on view in the Department of Zoology and Comparative Anatomy.

Those attending the Congress are urged to bring exhibits and thus contribute to the success of this meeting. Exhibitors should please, when returning their form of application, state the nature of their exhibits, giving details of space required and any other facilities (microscopes, lighting, etc.).

COLLECTIONS OF THE HOPE DEPARTMENT

Specialists wishing to study particular sections of the collections of the Hope Department of Entomology are asked to communicate their requirements well beforehand. Arrangements can then be made for their study on the Friday or Monday afternoons or, preferably, before or after the Congress.

Programme

Friday, 3rd July

2.30 p.m. Congress Office opens at Jesus College (till 10.30 p.m., except 6.45 - 7.45 p.m.).
The University Museum will be open for the reception of visitors' exhibits by a member of the Hope Department staff (till 6.30 p.m.).

3.45 p.m. Light Tea served in Common Room at Jesus College (till 5.15 p.m.), price 1s. 6d.

4.30 p.m. Guided tour of two of the Oxford colleges, probably Christchurch and New College, conducted by Mrs. Gilbert Hopwood (finishing about 6.15 p.m.).

7.00 p.m. Dinner (day visitors, price 7s. 6d.).

8.00 p.m. Film display by Dr. H. B. D. Kettlewell, M.A., M.B., F.R.E.S.: "Evolution fast and slow."

Social evening.

Saturday, 4th July

Morning

9.00 a.m. Congress Office re-opens in the Department of Zoology and Comparative Anatomy, University Museum (till 9.50 a.m., also 1.40 till 2.10 p.m.).

10.00 a.m. ADDRESS OF WELCOME TO THE CONGRESS.
Professor G. C. Varley, M.A., PH.D., Hope Professor of Zoology (Entomology) in the University.

PRESIDENTIAL ADDRESS.
G. J. Kerrich, M.A., F.L.S., F.R.E.S.: "The state of our knowledge of the Hymenoptera parasitica."

11.00 a.m. Coffee (6d. per person).

11.15 a.m. Official photograph (in the forecourt of the University Museum).

11.40 a.m. ADDRESS.
Eric Goto, B.SC., F.R.E.S.: "An experimental approach to the systematics of Collembola."

1.00 p.m. Luncheon (day visitors, price 2s. 6d.).
Coffee in Common Room (price 6d.).

Afternoon

2.15 p.m. ADDRESS.
D. W. Wright, M.A.: "The effect of soil insecticides on the cabbage root fly (*Hylemyia brassicae*) and on its predators."

3.10 p.m. ADDRESS.
T. T. Macan, M.A., PH.D., F.R.E.S.: "The population of a fishpond."

4.10 p.m. Tea (price 2s. 6d.).
EXHIBITION MEETING. Exhibits brought by members, and selected parts of the collections of the Hope Department of Entomology, will be on view.

Evening

7.00 p.m. CONVERSAZIONE at Jesus College.
Reception by the Hope Professor and Mrs. Varley, and by the President of the Society for British Entomology and Mrs. Kerrich.
Sherry.

7.30 p.m. CONGRESS DINNER (day visitors, price 12s. 6d.).
Lounge dress will be worn for Reception and Dinner.

Sunday, 5th July

ALL-DAY EXCURSION TO THE CHILTERN HILLS.

9.45 a.m. A coach will leave from near Jesus College for Bald Hill and Beacon Hill, near Lewknor. Price of tickets: 10s. 0d. each. Residents will be provided with a packed lunch. The party will later proceed to Stokenchurch in time for Afternoon Tea. The area to be investigated is an interesting extent of chalk downland, including the Beacon Hill Reserve, which will be visited by kind permission of the Nature Conservancy.

4.30 p.m. Tea at the King's Arms Hotel, Stokenchurch (price 3s. 6d.).

5.20 p.m. Coach leaves to return to Oxford.

7.00 p.m. Dinner.
Social evening.
Informal discussion of the day's collecting.
Business meeting if required.

Monday, 6th July

9.30 a.m. ADDRESS.
J. W. S. Pringle, SC.D., F.R.S.: "The flight of bees."

10.30 a.m. Coffee (price 6d.).

10.45 a.m. ADDRESS.
Professor G. C. Varley, M.A., PH.D.: "The oak survey at Wytham Wood, Berkshire."

11.00 a.m. ADDRESS.
G. R. Gradwell, M.A.: "Oak feeding Lepidoptera."

11.50 a.m. ADDRESS.
M. F. Claridge: "The phytophagous habit in the Chalcidoidea (Hymenoptera)."

12.40 p.m. VALEDICTORY ADDRESS.

1.00 p.m. Luncheon (day visitors, price 2s. 6d.).
Coffee in Common Room (6d. per person).

2.20 p.m. EXCURSION TO WYTHAM WOOD, where much of the ecological work of the Hope Department is carried out, led by Professor G. C. Varley and Mr. G. R. Gradwell.

END OF CONGRESS

FORM OF APPLICATION

(To be completed by all persons attending any part of the Congress)

TO. HON. ORGANIZING SECRETARY,
Eleventh Congress of British Entomologists.

RESIDENTS

I shall attend the Congress to be held at Oxford from 3rd to 6th July, and expect to arrive at about .... on the .... July, and depart about .... on .... July.

I shall require accommodation for ....

.... at Jesus College at the inclusive charge for the period of three days, including gratuities, of £4 10s. od. per person, or in proportion for shorter or longer stay.

I shall require .... seats in the coach to the Chilterns on Sunday, 5th July, at 10s. od. each.

I shall/shall not require transport to Wytham Wood on Monday, 6th July.

I shall require .... Congress Admission Tickets at 5s. od. each.

DAY VISITORS

I shall attend the Congress on .... July.

I shall require .... seats in the coach to the Chilterns on Sunday, 5th July, at 10s. od. each.

I shall require .... Congress Admission Tickets at 5s. od. each.

I shall require the following meals:

.... Afternoon Teas on Friday, 3rd July, at 1s. 6d. each
.... Dinners on Friday, 3rd July, at 7s. 6d. each
.... Luncheons on Saturday, 4th July, at 2s. 6d. each
.... Afternoon Teas on Saturday, 4th July, at 1s. 6d. each
.... Congress Dinners on Saturday, 4th July, at 12s. 6d. each
.... Afternoon Teas on Sunday, 5th July, at 3s. 6d. each
.... Dinners on Sunday, 5th July, at 7s. 6d. each
.... Luncheons on Monday, 6th July, at 2s. 6d. each
.... Afternoon Teas on Monday, 6th July, at 1s. 6d. each

Name.................................... Date....................

Address ....

....

Name of Society (if a Delegate)....................................

This form to be detached when completed and forwarded as soon as possible to Dr. M. W. R. de V. Graham, Hope Department of Entomology, University Museum, Oxford. Remittances should be made payable to the above, or payment may be made on arrival.

SYDENHAMS, PRINTERS, BOURNEMOUTH

SOCIETY FOR BRITISH ENTOMOLOGY

All official correspondence should be sent to the Secretary of the Society

All applications for membership should be made to the Hon. Treasurer

Editorial communications should be sent to:

E. J. POPHAM
DEPARTMENT OF ZOOLOGY, THE UNIVERSITY, MANCHESTER 13

The author of any published paper shall, *if he so request at the time of communicating such paper*, be entitled to receive twenty-five copies thereof gratis

Information regarding the Society may be obtained from the Secretary

CONTENTS

Printed by SYDENHAM & Co. (Est. 1840) LTD. ,Printers, Oxford Road, Bournemouth